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AMONG THE AUTOMOBILES.

We devote a liberal portion of our space this week to the show being held in Madison Square Garden under the auspices of the Automobile Club of America. That body is to be heartily congratulated on the success of its venture, which bids fair to be the first of a long line of shows of the kind for the promotion of the art. The show is highly representative of the various developments and conditions as they exist throughout the field to-day, and the public will have derived a good deal of instruction and amusement from it before the week is out. On the other hand, the club will, we trust, have derived such substantial benefit as will enable it to carry out some of the public objects which it has most at heart.

That electrics are well to the front must be the firm opinion, we think, of every one who has visited the show. In ease of control by man or woman, in cleanliness, in absence of odor, heat, vapor, and jar, they are unapproachable; and while all the other types have undeniable merits it is clear that the electrics are in the competition to stay, sure of public approval and patronage, particularly in the cities. While we prefer a substantial vehicle ourselves, we must confess to a strong feeling in favor of the light new "piano box" electric automobiles so much in evidence at this show, with lessened weight of battery and a marked diminution in price. For these a large range of customers awaits, to whom with increasing facilities for charge, a new pleasure opens up denied to them under the old régime of the horse. It may be added that while the club has not encouraged any racing this week at the Garden, it has favored contests whose object is to illustrate to the public the ease with which automobiles can be handled in a crowded street or braked within a very few feet.

THE SAFETY OF ELECTRICITY.

Last week we took occasion to condemn promptly the cry that went up from certain newspapers in this city—notably the *New York Herald* and the *Evening Telegram*—that electricity was to blame for the frightful Tarrant explosion. At that time there was absolutely no evidence against electricity, and every step in the investigation since has only gone to prove that whatever the origin was, electricity had nothing to do with it. Apparently the fire broke out in a room where gas was in use for heating some compound. We say "apparently," for it will give us pleasure to find presently also that gas had nothing to do with it also. And were it either gas or electricity, that should not divert attention from the deep sin and real responsibility of those who filled up that great magazine of inflammables and explosives in this compact and densely populated metropolis.

This week there was another fire and explosion in New York of a serious nature, wrecking a five-story building, with damage of at least $100,000. Here all the evidence points to gas, carelessly left burning by somebody, but not a newspaper has raised its voice to point out the dangers of gas. If the damage had been ten times as great, with loss of life, people would not have had the perils of gas urged on them in scare headlines and sensational paragraphs. We venture to suggest to journals that do not wish to be classed as "yellow" that they might as well recover their common sense in regard to man's latest and best agent. To which might be added that while electrical utilization is still imperfect in its methods, electrical engineers do not have to be taught by frothy daily newspapers the worth and desirability of good insulation.

Cost of Lighting.

We note that the Detroit Public Lighting Commission has just issued its fifth annual report. The statement is made that the gross cost per arc light operated is $66.45 per year, but we note that the depreciation over the whole is figured at only 3 per cent per annum, while nothing appears to be allowed in the nature of a reserve. The plant has been running five years, so that our readers can determine for themselves the value of such a scale of depreciation, conceding the excellence of the apparatus in the fullest degree. Just now when arc lighting is at a point of new departure in methods and apparatus, the city stands a great chance of having an old-fashioned system before it can realize the fact, but that does not show in any depreciation estimates. However, the city will wake up to it some day, and meantime may compliment itself on having a commission that apparently is doing well its duty as that duty presents itself to an uninformed non-expert.

It is a pity, however, that the commission, whose members, we take it, are themselves engaged in private enterprises, should see fit to remark: "The political health of the city has been improved by placing one branch of the public service beyond the reach of franchise-seeking corporations; and the attention of our city government is not now distracted by the bickering and bargaining of such corporations eager to obtain the privileges and the profits that may be secured through contracts for public lights." We are sure that this point of view, the advantage of excluding all competition in and for such a service, remains a very doubtful one. Many like ourselves are not enthusiastic believers in it. Some, like ourselves, are fain to attribute to the energy, courage and pioneer work of these private corporations nearly all the benefits that modern cities now enjoy, from water supply to street railways. One of these fine days the commissioners will get touched on the raw in their own business, and will be more charitable and fair to their fellows.

Induction Motors.

In this number we continue the series of articles by Mr. Behrend upon the alternating-current induction motor. Much work has already been done towards simplifying the theory of this useful machine, but much yet remains to be done in this direction. When the multiphase induction motor was first constructed, it was a very crude and defective piece of apparatus. It was relatively weak and had a tendency to heat at the expense of a tendency to start. Gradually, however, as engineers became acquainted with the principles upon which the machine is based, it improved in power, power-factor, efficiency and appearance, until the induction motor is to-day a very valuable machine with a wonderful capacity to withstand abusive treatment and a simplicity of structure that is surprising. Still further progress may be expected, as the theory and practice of the machine are elaborated and developed, and Mr. Behrend's studies in this direction will no doubt be acceptable to the student of alternating-current machinery.

Grounding of Low-Potential Circuits.

In the report of the special committee of the Underwriters' National Electric Association on this subject, dated Aug. 1, 1900, and to be referred to the December meeting of the association, it is proposed to permit the neutral point of low-potential systems to be connected permanently to ground, and this we consider a good and judicious recommendation. In the first place, the neutral point of a well-insulated system is *ipse facto* a point which is normally at the potential of the earth, so that the permanent connection of this point to the earth in no way alters the normal electrical condition of the system. If the system is not normally well insulated; or, if although normally well insulated, it becomes abnormally and temporarily grounded, then the risk of short circuits is reduced by the permanent ground connection, because the pressure at which such short circuit can take place is only half the pressure employed in the system, and therefore half of the pressure which might be active if no ground connection were employed. Whether the conductors of Edison three-wire systems are on poles, as in the country towns, and, therefore, liable to crosses with high-pressure conductors; or whether they are in buried pipes as in the cities, and are supplied through converters from high-pressure generating stations, it is equally important that the low pressure system be prevented from attaining the voltage of the high-pressure system if temporarily and accidentally brought into connection therewith. Similarly, in alternating-current systems, it is important that each secondary distribution system or house wiring should be incapable of rising to the primary high pressure by reason of any accidental fault in the transformer due to lightning or imperfect insulation between the windings. If the secondary wiring and lamp mains should accidentally become connected with the high-pressure distributing mains, a danger to life, not to speak of danger to property, might ensue at any moment when a leak was momentarily made to ground from the lamp circuit, either through a person standing on a cellar floor or through a defective lamp cord coming into intimate contact with a gas pipe.

The permission to ground the neutral point of secondary systems would be welcomed by all those who have the welfare of the electric industry at heart, and who desire to see the greatest use of electricity, accompanied by the minimum risk in its use.

Low-Potential Systems.

As time proceeds and the electric arts advance, it becomes more difficult to decide as to what magnitude of electric pressure in a system of distribution distinguishes a low-pressure system from a high-pressure system. The question is, of course, one of degree, and not of kind. Electric distribution pressures are determined by the nature of the translating devices employed. In the ordinary case these are incandescent lamps, and the pressure of supply has been fixed and maintained in the past by the conditions of incandescent lamp manufacture. At the time when incandescent lamps were first made for practical use, the difficulty was to obtain a carbon filament sufficiently thin and uniform to withstand a pressure of 100 volts. Eighty volts was, in fact, about the first standard pressure. Then with improvements in lamp manufacture, 100 volts was reached, and later 115, which is to-day approximately the central station standard of our large cities. The very fact, however, that the three-wire system with its 230-volt pressure came into use with such lamps, proves that the pressure of 115 volts was determined solely by the lamp, and that if equally good and equally cheap lamps of 230 volts pressure were obtainable, they would immediately replace their 115-volt prototypes.

At this time 200-volt lamps are in use, although they are not so highly esteemed as 100-volt lamps in the points of cost, efficiency and durability, it being manifestly much more difficult to produce a good 200-volt lamp than a good 100-volt lamp; in the same way that it is harder to make a good 100-volt lamp than a good 50-volt lamp of equal candle-power.

If 230-volt lamps were as much in favor as 115-volt lamps, we might expect to find existing three-wire systems replacing their lamps and doubling their pressures. Or, if the Nernst lamps should prove a commercial success, we might expect to find new systems springing up in which 500 volts was the standard distribution pressure. Such a

system would have twice the commercial radius, or four times the commercial area, of direct distribution from a central station, without the intervention of transformers or pressure-varying devices. This would tend to reduce the cost of distribution, and consequently also the cost of electric light to the consumer. Moreover, there are some distribution systems in existence at the present time which do actually distribute at approximately 500 volts pressure. It is difficult to see how such systems can be considered as high-pressure systems. One of the ideas conveyed by the term "high-pressure system" is that the pressure cannot be immediately used for the supply of incandescent lamps, but has to be reduced by special apparatus in order that lamps may be supplied. On this basis such 500-volt systems are not high-pressure systems, and per contra must be classed with low-pressure systems.

There is, of course, a point at which such a line of reasoning must terminate. If, for example, good and cheap lamps could be made for a pressure of 1000 volts, it is questionable whether they would be used in house lighting, on account of the danger to life or property in the use of such pressure in house wiring. There seems to be little doubt, however, that the danger to life or property of 500 volts is negligible, if the ordinary proper precautions are taken in the fixtures, wires and circuits; so that, up to that limit at least, no reasons seem to exist for excluding 500-volt distribution systems from the class of low-pressure systems. It is, therefore, interesting to notice that in a report of the special committee appointed by the Underwriters' National Electric Association to consider the grounding of low-potential circuits, it is proposed to amend the rule defining low-pressure systems, by raising the limit of pressure of such circuits from 300 to 550 volts, and we hope to see that recommendation adopted in the Underwriters' Rules. Due attention should, of course, be given in the execution of such rules to see that proper insulation and wiring is employed in 500-volt sysems.

THE PROBLEM OF ALTERNATING ARCS.

We are bringing to the attention of our readers this week an interesting account of some recent work on the alternating arc, based on its study by means of the oscillograph. One of the valuable bits of information impressed by Mr. Wiler's research is the general kinship between the continuous and the alternating current arcs when the actions going on in the latter are considered in detail rather than *en masse*. Following out the operations as they succeed each other in the alternating arc, one gains a clearer insight into the real nature of the phenomena than can be gained in any other way. In many cases of alternating current work, one can go confidently along with the familiar equations based on sinusoidal waves and reach correct results. But it is well to remember that sometimes, as in the case before us, the essential characteristics of the phenomena depend on the non-sinusoidal character of the waves involved. In such cases, the oscillograph has proved an invaluable means of investigation by showing, not what might occur with waves as we would like to have them, but what does occur with waves as we find them.

This matter of alternating arcs, too, as we pointed out last week, is one of most serious import in the development of the art of electric lighting. It is, in fact, the crucial factor in the evolution of the alternating current for general purposes. A decade since alternating methods of distribution were decried as wasteful, hopeless in the matter of motor service and altogether unpromising. At that time the constant potential arc for continuous current circuits was in a very imperfect condition and commercial arcs were habitually operated from series circuits. The years that have passed have wrought a tremendous change in the conditions. The low potential system of distribution has been beautifully supplemented by most satisfactory constant potential arcs, but the working radii of such systems have so increased that they are rapidly being driven to transmission by alternating currents, however strongly some may kick against the pricks. The modern alternating systems have shown beautiful adaptability to the needs of distribution on a large scale, and have brought into use motors on the whole intrinsically superior to direct current motors for many purposes. But in the matter of arc lighting they have not kept pace with the low tension direct current systems, and to-day commercial arc lighting is the weakest point of alternating current distribution, and the one thing in which it is at a material disadvantage.

In the last year or two we have had the pleasure of examining a very wide variety of alternating arc lamps, of foreign and domestic make, and working both at constant current and constant potential. On the whole, we must admit that in spite of all the clever and intelligent work that has been put upon it, the present state of the art is not satisfactory. For street lighting on the series system alternating arcs have been worked up to a thoroughly practical point, and are coming into very extensive use. Of course, an alternating arc takes *per se* more watts per mean spherical candle-power than a direct current arc. On the other hand, when worked at or near full load, the constant current alternating system worked from big direct coupled alternators is materially more efficient than the continuous current series system worked from arc machines. Taking this duly into account, the alternating systems are in very good shape to take up street lighting, where the circuits can be worked nearly always at full load. and the conditions are such that the slight noise of the alternating lamps is in no wise objectionable. But when it comes to commercial arc lighting, the case is widely different. For general indoors use arc lights must be singularly steady and quiet. The alternating arc lamps now available fulfill both conditions in a measure, and most of the time, but not completely nor all the time. Many of them are capable of giving very good service under ordinary conditions, but there is no concealing the fact that they do not compare favorably, week in and week out, with first-class arc lamps worked off a constant potential direct current system. To be sure, in the mere matter of efficiency the two classes of lamps are equalized by the fact that the direct current arc wastes, as generally used in this country, so much energy in dead resistance as to offset its greater intrinsic efficiency. But the constant potential alternating arc is, as a rule, less steady, and often objectionably noisy, in spite of enclosing the arc and improving the mechanism.

In fact, the enclosed alternating arc suffers in the matter of noise from the fact that the degree of volatility in the carbons which would be desirable for giving the highest luminous efficiency and minimum noise, is forbidding to enclosed arcs on account of blackening the inner globes. Also, the high current density which for the same reasons would be desirable cannot be secured with a long arc without employing a large extra amount of energy. An enclosed arc taking no more than 350 watts looks thin and bluish, while if the current is sent up to 7.5 or 8 amperes the inner globes suffer. The open alternating arcs worked with heavy current at 40 to 50 volts, and using the finest grade of soft cored carbons, make a good showing in efficiency and quiet and steady running, but are rather expensive to run, and hence have made small headway in this country. We think more that there is no branch of the art of electric lighting which more deserves the persistent and vigorous work of inventors and manufacturers than this of constant potential alternating arcs. The pace is set by the competition of direct current constant potential arcs, and we are bound to say that it is a hot one.

Electricity in the New York Sound Money Parade.

Note has already been made in these pages of the organization of the Electrical Industries Association with the object of securing a large representation of electrical engineering and trade in the Sound money Parade. Although it was the first time that anything of the kind had been attempted within the electrical field, the success was instantaneous, and it is the duty of this journal, altogether aside from questions of politics, to record that notable and shining fact. Not only did the heads of large concerns at once take an active part, but in many instances the men were ahead of them, evincing once again that strong artisan pride in the industry itself which has always prevailed among those engaged in electrical applications. It was a constant matter of surprise to those who were responsible for the movement to see the desire for participation shown in all quarters. At the first counting of heads, the returns showed that possibly 2500 to 3000 might take part. Then the figures went up to 3750, and at the last meeting prior to the parade, there was indicated a possible 4200. For this number badges and flags were provided, but at least an hour before starting both forms of personal decoration had run out, and any division with a spare badge or a stray flag found its surplus snapped up without parley. When it is stated that it rained hard all the morning of Saturday last, and that when the paraders in the Electrical Industries brigade started, it was still raining steadily and the streets were a sea of mud and slush, the grim spirit of earnestness that pervaded every platoon will be appreciated.

The proceedings began early in the day, for the association. Messrs. J. H. McGraw and T. Beran (General Electric Company), were appointed to represent the body on the general executive and reception committee, accompanying Governor Roosevelt, and Mr. R. E. Gallaher (New York Insulated Wire Company) was the committee member at the reviewing stand on Madison Square. Possession was taken of headquarters at 5 and 7 Dey Street early in the day, and regalia was stored there in large quantities. Orders had been issued to assemble by 2:30 p. m. on Dey Street, with the scheduled hour for starting of 3:25, and the whole street was filled up, as well as Church, Greenwich and Washington. At the head of the line was the large banner of the association carried by three men, and the band. Then came the marshal, Mr. H. L. Shippy, wearing the large official blue sash, with Major Robert Edwards, Jr., as chief of staff, and Avery Eckert, assistant chief.

The marshal's aides were J. L. Kirkland; A. F. Stanley, G. L. Patterson and A. S. De Veau, of Stanley & Patterson; C. O. Baker, Jr.; Marston Cockey, of Roeblings'; Max Loewenthal; C. W. Price, *Electrical Review*; A. F. Moore, A. B. Swift, John Eastwood; G. D. Pitman, Sibley & Pitman; U. N. Bethell, New York Telephone Company; Mr. Bangs, American Telegraph & Telephone Company; John Dale, H. W. Baker; H. Salt and A. L. Salt, Western Electric Company; G. F. Porter, Brixey Kerite Company; H. C. Adams, Phillips Insulated Wire Company; J. P. Hall; W. L. Lawton, Elektron Manufacturing Company. After the aides came Mr. E. S. Keefer, president of the association, and then three lines of vice-presidents, captained by T. C. Martin, ELECTRICAL WORLD AND ENGINEER, and H. B. Kirkland, American Circular Loom Company. They were J. C. Hatzel, of Hatzel & Buehler; Dr. Louis Duncan, C. T. Child, *Electrical Review*. A. E. Chandler, Woods Motor Vehicle Company; Joseph Wetzler, Electrical Engineer Institute of Correspondence Instruction; E. E. Higgins, *Street Railway Journal*; J. M. Wakeman, McGraw Publishing Company; W. S. Eckert, W. M. Miner, Knickerbocker Telegraph & Telephone Company; Ira D. Henry, Safety Insulated Wire & Cable Company; R. Corey; W. H. Johnson, Electric Vehicle Company; C. E. Phipps, General Electric Company; J. W. Godfrey, Habirshaw Insulated Wire Company; E. E. Ries, Automatic Telephone Company; A. A. Knudson, S. A. Chase; F. A. Pickernell, E. E. Wood, American Telegraph & Telephone Company; E. B. Latham; I. M. Post, Manhattan Electric Supply Company; John Hunt, Zimdars & Hunt; J. W. Waldman, B. M. Downs, Brookfield Glass Company; W. J. Newton, Newton Electric Company.

Succeeding the officers of the association came the splendid regiment of the Western Electric Sound Money Club, as the first division, commanded by Mr. Russell, with Mr. Albright, president of the club, at the head. There were no fewer than 75 companies of 16, each with its captain, say, 1275 men in line. The club had its own banner, and marched wonderfully well, due, it is whispered, to the zeal with which the men had practiced the goose step lately in the dinner hour. The second division, headed by the Naval Reserve Band, and commanded by Dr. S. S. Wheeler, consisted of the Crocker-Wheeler Sound Money Club, 510 strong; Manhattan Electrical Supply Company, 125 (Mr. Gorman); Dale Company, 85 (Mr. R. J. Sime); Sibley & Pitman, 17; Schiff, Jordan & Co., 17 (Mr. Frorup); Lowe & Loveridge, 17—say, 725 men.

Next came the third division, commanded by Col. A. C. Bakewell, with the Sprague Electric Company's band, and with the Sprague Sound Money Club, 425 strong, having the right of line. With these were associated the New York Telephone Company, 102; General Electric Company (Mr. Bates), 51; Stanley & Patterson, 75; E. B. Latham & Co., 17; Manufacturers' & Inventors' Electric Company, 17; Bunnell Electric Company, 34; Randolph & Sullinger, 17—say, 725 men. The fourth division followed, commanded by Mr. W. V. Marquet, headed by the Safety Drum Corps and band, and headed also by the Safety Insulated Wire & Cable Company Sound Money Club, 220 strong. Then came the Westinghouse Electric & Manufacturing Company, 51; W. R. Ostrander (S. C. Lascelles), 51; Edison Electric Illuminating Company, 51; J. Jones & Son, 34. In this division marched also the automobile division, 250, under command of Col. Robert McAllister Lloyd, bearing a distinctive banner of their own. The total of this division was somewhere around 700.

The fifth and last division which grew and grew so that by the time it started it may have mustered 1000 strong, was the "miscellaneous" and was under command of Mr. Chas. P. Bruch, assistant general manager, Postal Telegraph Company, who had with him immediately the Sound Money Telegraph Club, 275 strong. The Recreation Pier Band headed this division. After the operators came John A. Roebling's Sons Company, 51; Eddy Electric Motor Company (Mr. H. B. Coho), 51; Bishop Gutta Percha Company (Mr. Reed), 51; Bullock Electric Manufacturing Company (Mr. R. T. Lozier), 17; Columbia Electrical Supply Company (Mr. Douglas), 17; McGraw Publishing Company (Mr. H. W. Blake), 17; Electrical Press, 17; Electrical Engineers, 17; Tucker Electrical Construction Company, 34; Holloway & Irish (Mr. W. F. Holloway), 17; J. T. Whitehead, 17; Hatzel & Buehler, 17; A. Krantz, 34; Foote, Pierson & Co., 51; New York Steam Company, 51; late enrollments, 350. In some few instances these figures were possibly lower than stated. In many they ran far beyond the enrollment.

Each division had its blue and gold divisional flag, and every line had its guidon, of gold lettering on a white silk ground. Every man in line had a flag and handsome silk badge, and the officers who carried uniform canes, had special badges indicative of function. When it is considered how quickly everything had to be done as soon as it was determined that the electrical men should march in a section by themselves, the greatest credit is reflected on all who took part in forming the organization. It was certainly an admirable example of executive capacity applied promptly with wonderful results. It may be noted that as the Electrical Industries Association passed the reviewing stand its officers all gave the formal salute and the bugler played the Governor's salute call, an incident which Governor Roosevelt noted instantly. About the same time the strings of incandescent lamps around the stand were lit up, making a very pretty spectacle. The Columbia Supply contingent carried small batteries, bells and lamps.

Sound Money Parade in Chicago.

In the Sound Money Parade in Chicago on Oct. 27 the electrical industries of that city turned out some 1400 strong in a total of about 36,000 men in line. They were in the first division of the procession. Mr. H. E. Niesz, of the Edison Company, was marshal. The first contingent was that of 650 men of the Edison and Commonwealth Companies under the command of Col. J. F. Gilchrist, and headed by a band of 30 pieces. They were in a style of "rough rider" uniform. After them, with a bugle corps of 16 pieces, came the representatives of the General Electric, Central Electric, Electric Appliance, Illinois Electric, Kohler Brothers, Guarantee Electric, Reliable Electrical Supply and Dearborn Electric. These were under the command of Mr. J. Wolff, of the New York Insulated Wire Company, who had as aides G. P. Townsend, of the General Electric Company, and C. A. Munson, of the Fort Wayne Electric Works. The men carried canes with gold ribbon streamers. These were followed by the regiment from the Western Electric Sound Money Club, 500 strong, led by J. C. Warner, president, and J. B. Edwards. They carried canes and American flags and wore crimson badges. In the electrical division all the commanding officers and aides were mounted.

An Electrical Lead-Mining Plant in Missouri.

ONE of the most complete and interesting of recent power and lighting installations in the United States has been built by the St. Louis Smelting & Refining Company at Desloge, Mo. There are a great many coal and copper mines operated by electricity, but this is the first lead mine that is so equipped. Economy of operation is one of the first and most vital considerations in this particular branch of mining, as the lead ore is about 450 ft. below the surface, and the lead itself is very finely disseminated, generally about 6 to 10 per cent to the ton of ore. The ore is brought up in cars holding one ton each at a speed of 900 ft. per minute, by electric hoists, and dumped on the "grizzly" bars, where the smaller pieces fall into a bin underneath; the larger pieces are fed into crushers which are run at 250 r. p. m. There are seven crushers at each mine, belted to a jack shaft which is driven by a 100-hp electric motor, placed in the hoist house behind the electric hoisting machines. When running at full capacity, each hoist and crusher motor takes care of 600 tons of ore per day. When the ore is crushed, it drops into a bin, underneath which travels a belt conveyor connecting with the bins in the main concentrating mill. The ore from the other mines is all brought to this bin, which is the central storage supply for the mill; it is then fed into the crushing rolls from these bins which break it into pieces about one-eighth of an inch by one-quarter of an inch, at the rate of 1000 tons per day. This crushed ore goes to the jigs which separate the lead from the rock in water by gravity. It is handled by twelve centrifugal pumps driven by direct connected electric motors. Another centrifugal pump, driven by an electric motor, is used to keep the water out of the cut where the cars come in to receive the waste rock, which is called "chats." The lead ore which is left is known as "concentrates"; it is about 70 per cent lead, and goes from this mill to the roasting furnace and then to the smelter and refiner.

The centre of distribution of ore is at No. 2 mine—a trolley line a mile long connects No. 3 mine, and a line half a mile long connects No. 1 mine with this point, there being three shafts in all. It also connects with the main line of the Mississippi & Bonne Terre Railroad. There are three miles of single track, equipped with oak ties and 60-pound rails. There are two trolley wires overhead, positive and negative, because the current is used in the mines for lighting and power, and the danger of grounding would be great with a single trolley line and rail return. The trolley wires are suspended for the most part by side poles and brackets. Figs. 2 and 3 illustrate this work. G. E. No. 00 grooved trolley wire is used throughout, also G. E. standard fittings and suspensions for this style of line, with the exception of the crossings, which had to be made special, on account of the proximity of the two trolley wires. At all turnouts and some switches, span wire suspensions are used. The cars are drawn by 20-ton locomotives, Fig. 1, equipped with air-brakes and double trolleys. There is no arcing noticeable when the trolleys pass the ears on account of the smooth, uniform trolley wire surface, which is important where machines draw large amounts of current. The locomotives haul the ore from the mines to the central storage bins, the waste rock from the mill, and concentrates from the mill to the railroad siding, and the coal from the railroad to the power house dump. They also have a machine shop where all repairs are made which is run by a 10-hp electric motor, and a carpenter shop and sawmill by a 15-hp motor. There is also a 50-hp motor operating a triplex pump at the river, which is 3000 ft. from the mill. It delivers 1000 gallons of water per minute, which is used in separating the ore.

All the power is furnished from the central power house, which

FIG. 1.—DOUBLE TROLLEY LOCOMOTIVE.

FIG. 3.—STRINGING THE TROLLEY WIRES.

FIG. 2.—VIEW ALONG THE LINE.

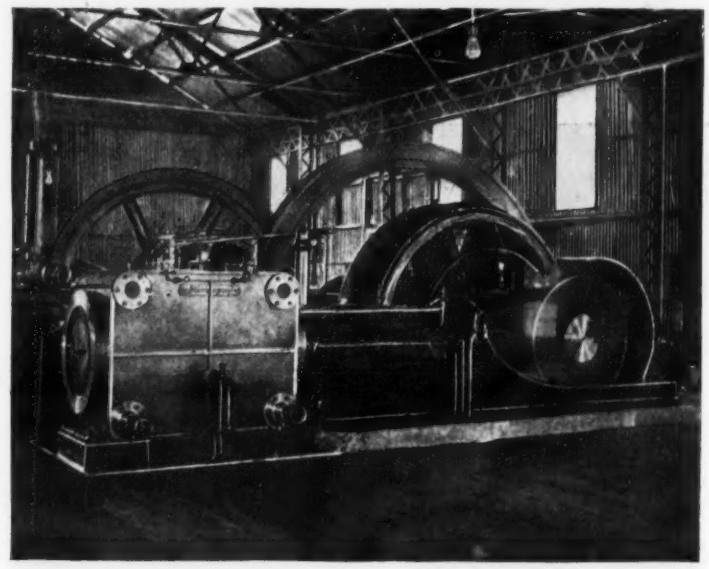


FIG. 4.—INTERIOR OF POWER HOUSE.

has a railroad siding alongside the boiler room, where the coal is dumped. The boiler room contains four 300-hp B. & W. water-tube boilers, and the engine room one 850-hp cross-compound condensing Corliss engine, direct connected to a 250-kw 500-volt compound-wound generator; the balance of the power from this engine is used to drive the jack shaft in the mill, which in turn drives all the jigs and rolls. There is a 350-hp cross-compound condensing Corliss en-

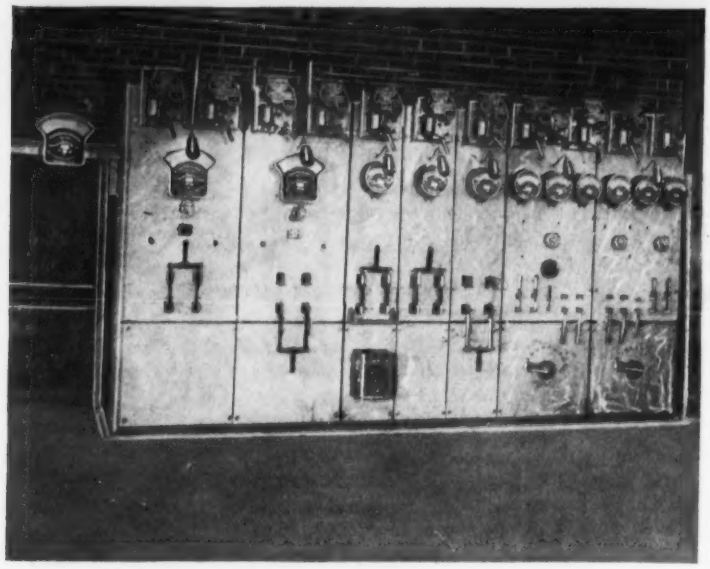


FIG. 5.—SWITCHBOARD.

gine direct connected to a 250-kw compound-wound generator, Fig. 4, and a cross-compound condensing tandem Corliss valve air compressor, capable of compressing 250 ft. of free air per minute to 100 pounds per square inch. The air is used in operating rock drills in the mines and signals overhead. There is also a chloride storage battery, Fig. 6, of 250 15-plate type F cells, and booster with motor, direct connected, having a capacity of regulating to the extent of 280 amp. on a variable load, having momentary fluctuations. The switchboard, Fig. 5, is made from blue Vermont marble, and is equipped with quick-break switches and magnetic blow circuit breakers. There are two gener-

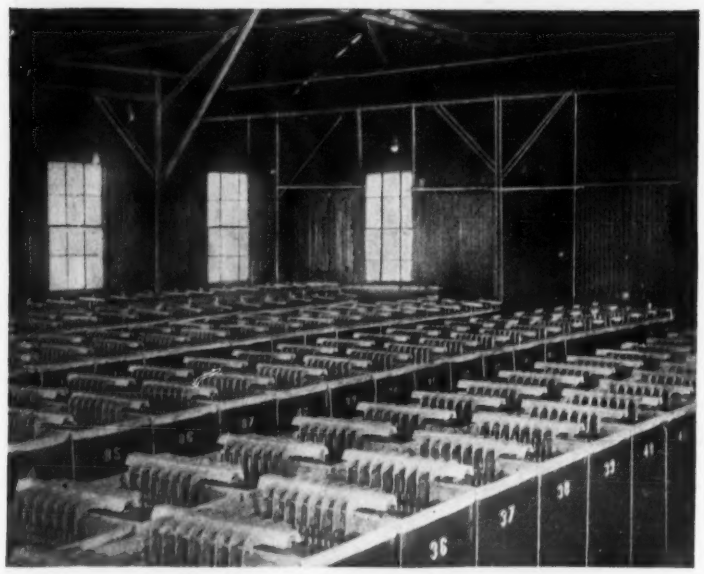


FIG. 6.—STORAGE BATTERY PLANT.

ator panels, three feeder panels and two storage battery panels; Fig. 7 is a diagram of connections.

The storage battery gives out from 70 to 80 per cent of fluctuating load, namely, when a hoist or locomotive starts, and maintains an absolutely constant voltage at the main bus-bars in the following way: The variable load bus-bars are not connected with the main bus-bars, except through the booster's series field when in regular operation. The series windings of the booster fields are wound in opposition to the shunt field windings, and consequently when there is a call for current on the variable load bus-bars, the current coming through the booster series coils automatically weakens the fields of the boosters (which are excited from the main bus-bars) and allows the current to feed out from the storage battery to the line in parallel with the series connections; the percentage of current required from the storage battery being regulated by the shunt fields of the boosters, so that when the load goes off, the proper proportion of the current will be boosted back into the storage battery and keep it fully charged ready for the next variable load call. A three-wire connection is made for arc and incandescent lighting; positive and negative leads being taken from the main bus-bars, and the neutral from the storage battery, as shown in the diagram of connections. This gives 250 volts on a side. G. E. enclosed arc lamps are used singly across the 250 volts, and 250-volt incandescent lamps in the same way. The regula-

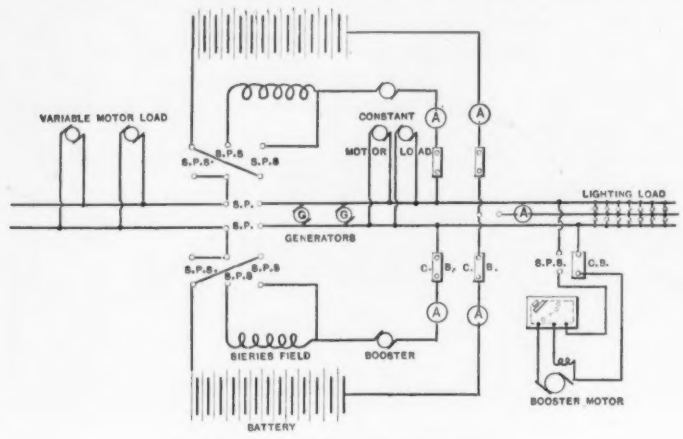


FIG. 7.—DIAGRAM OF CONNECTIONS.

tion is so close that no appreciable variation is noticed in the incandescent lighting at night, when all machinery is running. The current for each circuit is fed through a Thomson recording wattmeter; the total output is registered by one large meter connected to the main bus-bars.

The dynamos and motors were all furnished by the General Electric Company, and the storage battery by the Electric Storage Battery Company. This plant was planned and installed under the direction of Messrs. Floy & Carpenter, of New York, consulting engineers. The work of installing the electrical plant was superintended and carried through to a very successful conclusion by their Mr. Alexander Anderson. This plant is one of the most modern and up-to-date specimens of the economy and flexibility of electricity for power and light.

Engineering Education in the United States at the End of the Century.

In a recent address by I. O. Baker, president of the Society for the Promotion of Engineering Education, and Professor of Civil Engineering at the University of Illinois, he said that the first engineering college giving engineering instruction not military was founded in Troy, N. Y., in 1825; in 1862 there were only four engineering colleges. In 1862 Congress passed the Land Grant Act which has resulted in the establishment of 64 technical schools. There are at present 89 institutions in America giving instruction in engineering with an attendance of 9679 students in 1899. During the decade 1889-99 the number of students increased from 3043 to 9659, a gain of 317 per cent; and the graduates increased from 483 per annum to 1413, a gain of 242 per cent.

In 1889-99, at twenty-three leading institutions, the average per cent of graduate to undergraduate students in non-engineering departments was 9.94; in engineering departments 2.3 per cent. The reasons given by Prof. Baker for this difference in the number of post-graduate students are: (1) non-engineering graduates pursue post-graduate study to fit themselves for teaching, while the future engineering teacher prefers to engage in actual practice to prepare for teaching; (2) many engineering students pursue an engineering education with the idea of realizing financial returns and not unnaturally feel that they should get into practice; (3) the non-engineering graduate usually returns for research work, while the engineering graduate usually has a better opportunity for this sort of experience in actual practice than in college environments. In conclusion, Prof. Baker discusses entrance requirements, and make a plea for as many of the general culture subjects as possible.

The Induction Motor—II.

BY B. A. BEHREND.

A.—THE CHARACTER OF THE MAGNETIC FIELD IN THE POLYPHASE MOTOR.

THE magnetic field in a three-phase current motor is produced by three windings, I, II, and III, Fig. 7. If the current in III is a maximum, and if the currents vary according to a simple sine curve, then the currents in I and II are each equal to half the current in III. The magnetomotive forces of each phase are represented by the ordinates of the curves I, II, and III respectively. Each ordinate measures the magnetomotive force produced in that place of the circumference in which it is drawn. The adding up of the three curves yields the thick line curve drawn below.

If the magnetic reluctance is the same at every point of the circumference, in other words, if the reluctance of the iron is negligible, then the flux, produced by the magnetomotive force represented by the thick line curve, is proportional to that magnetomotive force. Hence the thick line curve may be taken as a representation of the flux. We call the total number of lines of induction N, and we assume that this flux varies according to a simple sine law. We shall now proceed to calculate the e. m. f. induced by this field upon each phase.

We have tacitly assumed that the coils I, II, and III are distributed in a practically infinite number of slots. Though this cannot be the case, yet this assumption may safely be made for our present purpose.

It is obvious that, if the convolutions of each phase were all concentrated in one slot, the effect of the oscillation or the traveling of the field would be to set up an e. m. f. equal to $2.22 \sim z \,.\, N \,.\, 10^{-8}$ volts; however, through the distribution of the winding, only the parts of the flux not covered with hatchings can produce an e. m. f. expressed by this formula, while the hatched parts of the field will have a considerably smaller effect. The induced e. m. f. can be calculated as follows: The width of the coil is $2b$; there are n conductors in the coil spread over $2b$. Per unit length there are, therefore, $\frac{n}{2b}$ conductors, hence the element dx contains $dx \,.\, \frac{n}{2b}$ conductors. The number of lines of induction threading the conductors in the element dx is equal to N_x represented by the hatched area. We have, therefore,

$$de = 2.22 \,.\, \sim \,.\, \frac{n}{2b} \,.\, dx \,.\, N_x \,.\, 10^{-8} \text{ volts.}$$

$$N x = B \,.\, \frac{b}{2} - B x \,.\, \frac{x}{2} = B \left(\frac{b}{2} - B \,.\, \frac{x^2}{2b} \right)$$

Hence

$$de = 2.22 \,.\, \sim \,.\, \frac{n}{2b} \left[\frac{B \,.\, b \,.\, dx}{2} - \frac{B \,.\, x^2 \,.\, dx}{2b} \right] \,.\, 10^{-8}$$

$$e = 2.22 \,.\, \sim \,.\, \frac{n}{2b} \left[\int_0^b \frac{B \,.\, b \,.\, dx}{2} - \int_0^b \frac{B \,.\, x^2 \,.\, dx}{2b} \right] \,.\, 10^{-8}$$

$$e = 2.22 \,.\, \sim \,.\, \frac{n}{2} \,.\, B \left[\frac{b}{2} - \frac{b}{6} \right] \,.\, 10^{-8}$$

$$e = 2.22 \,.\, \sim \,.\, \frac{n}{2} \,.\, B \,.\, \frac{b}{3} \,.\, 10^{-8}$$

We have $N = \frac{B \,.\, b}{2}$, therefore

$$(4) \ldots\ldots e = 2.22 \,.\, \sim \,.\, \frac{n}{2} \,.\, \left(\frac{2}{3} N \right) 10^{-8}$$

This is in words, the e. m. f. induced by the field N upon a coil of the width b is two-thirds as large as the e. m. f. which would be induced by the same field upon a coil which is not distributed, but lodged in only one groove. The latter case is represented in Fig. 9. It may not be amiss to call attention to the fact that a coil like that in Fig. 9 would produce a rectangular magnetic field twice as large as that shown in the figure. Hence the inductance of the flat coil is one-third as large as the inductance of the coil lodged in one slot.

The e. m. f. generated by the field in Fig. 7 can now easily be calculated.

The number of lines of induction represented by the white area in Fig. 7 is equal to

$$\left(\frac{2}{3} \,.\, t \,.\, 6 \,.\, B \right) \frac{3}{4} \,.$$

The e. m. f. produced by this flux is

$$e_1 = 2.22 \,.\, \sim \,.\, Z \,.\, \left(\frac{3}{4} \,.\, \frac{2}{3} \,.\, t \,.\, 6 \,.\, B \right) 10^{-8}$$

The hatched areas represent a flux equal to

$$\frac{1}{6} \,.\, t \,.\, b \,.\, \frac{B}{2}$$

The e. m. f. produced by this flux is

$$e_{II} = 2.22 \,.\, \sim \,.\, Z \,.\, \frac{2}{3} \left(\frac{1}{12} \,.\, t \,.\, b \,.\, B \right) 10^{-8}$$

Hence

$$e = e_1 + e_{II} = 2.22 \,.\, \sim \,.\, Z \,.\, \left(\frac{20}{36} \,.\, t \,.\, b \,.\, B \right) \,.\, 10^{-8}$$

The total flux amounts to

$$N = \frac{7}{12} \,.\, b \,.\, t \,.\, B, \text{ hence}$$

$$e = 2.22 \,.\, \sim \,.\, z \,.\, \frac{20}{21} \,.\, N \,.\, 10^{-8}$$

$$(5) \ldots . e = 2.12 \,.\, \sim \,.\, z \,.\, N \,.\, 10^{-8} \text{ volts.}$$

The ampere-turns in each phase which are needed to produce the

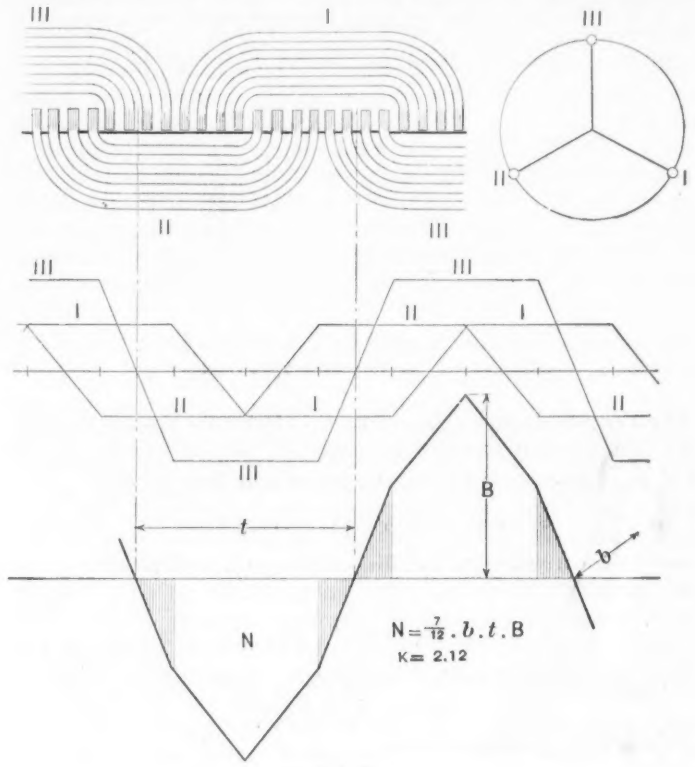


FIG. 7.

induction B in the air-gap are determined by the consideration, which follows immediately from Fig. 7, that

$$2 \,(0.4 \,\pi \,.\, n \,.\, i_0 \,.\, \sqrt{2}.) = B \,.\, 2 \,\triangle$$

In this equation i_0 is the magnetizing current, n the number of conductors per pole and phase, and $\triangle$ the air-gap in cm. The reluctance of the iron is supposed to be negligible.

From this equation follows

$$(6) \ldots\ldots\ldots\ldots\ldots i_0 = \frac{B \,.\, 1.6 \,\triangle}{2 \,n \,.\, \sqrt{2}} \text{ amperes.}$$

If the reluctance of the iron is not negligible, the magnetic induction B has to be determined point for point, which can easily be done with the help of a magnetizing curve. It is of importance to note that the maximum induction does not extend over a very large part of the pole-pitch, hence it is not objectionable to have an induction of 15,000 or 16,000 in the teeth, as this high induction hardly in-

creases the magnetizing current on account of its being limited to a very small part of the surface of the pole.

I have not entered upon a detailed consideration of the elementary phenomena in the polyphase motor, as they have been treated by Gisbert Kapp[2] and André Blondel[3] with a lucidity and clearness which it would be impossible for me to surpass.

B.—THE FORMULAE FOR THE THREE-PHASE CURRENT MOTOR.

It remains to prove that the theory of the general alternating current transformer is directly applicable to the poylphase motor. That this is true, as long as the armature of the motor is standing still, is evident. If the armature runs at synchronism, the number of its revolutions corresponds to the frequency of the feeding current $\sim_1$. If the armature runs slower than the field, the difference being $\sim_1 - \sim_2$, then an e. m. f. is induced in the armature proportional to the slip $\sim_1 - \sim_2$. If the armature resistance per phase is r_2, then a current will flow proportional to $\frac{\sim_1 - \sim_2}{r_2}$. The same current can be attained in the transformer with the secondary at rest, if the resistance be thus chosen that the relation exists

$$(7) \ldots\ldots\ldots\ldots\ldots \frac{\sim_1}{r} = \frac{\sim_1 - \sim_2}{r_2}$$

r signifies the internal and external resistance of the secondary of the transformer. Under this condition the same diagram represents the currents in size and phase in the transformer as well as in the motor. That this must be so becomes clear as soon as we remember that the impedance of the motor is equal to $\sqrt{r_2^2 + A(\sim_1 - \sim_2)^2}$, A being a constant. The impedance of the transformer is equal to

$$\sqrt{r^2 + A \cdot \sim_1^2},$$

hence

$$\frac{\sim_1}{\sqrt{r^2 + A \sim_1^2}} = \frac{\sim_1 - \sim_2}{\sqrt{r_2^2 + A(\sim_1 - \sim_2)^2}}$$

$$\frac{\sim_1^2}{r^2 + A \sim_1^2} = \frac{(\sim_1 - \sim_2)^2}{r_2^2 + A(\sim_1 - \sim_2)^2}$$

$$\sim_1 \cdot r_2 = (\sim_1 - \sim_2)\, r$$

which equation is identical with (7). Credit is due to Dr. Behn-Eschenburg, Oerlikon, for having first prominently put forth this relation.

The Torque.—Imagine the armature to be turned against the magnetic field, which is supposed to stand still, with an angular velocity equal to $\omega_1 - \omega_2$. If D is the torque in *mkg*, then we have

$$9.81 \cdot D \cdot (\omega_1 - \omega_2) = 3\, i_2^2\, r_2,$$

i_2 being the current in, and r_2 the resistance of, each phase.

We have

$$\omega_1 = 2\pi \cdot \frac{\sim_1}{p},$$

if p is the number of north or south poles. And also

$$9.81 \cdot D \cdot \omega_2 = P \text{ watts}.$$

From these equations follows

$$9.81 \cdot D_{mkg} \cdot \left(2\pi \cdot \frac{\sim_1}{p} - \omega_2\right) = 3\, i_2^2 \cdot r_2$$

$$9.81 \cdot 2\pi \cdot D_{mkg} \cdot \frac{\sim_1}{p} - P = 3\, i_2^2 \cdot r_2$$

$$(8) \ldots\ldots\ldots\ldots 61.6 \cdot D_{mkg} = \frac{p}{\sim_1}\,(3\, i_2^2\, r_2 + P \text{ watts}).$$

If we want to have the torque in foot-pounds, the formula is

$$8.5 \cdot D_{ft.\,lbs.} = \frac{p}{\sim_1}\,(3\, i_2^2\, r_2 + P \text{ watts}).$$

The torque is, therefore, proportional to the algebraic sum of the output of the motor plus the energy dissipated in the armature.

Starting Torque.—At starting P is zero. All the energy that goes into the motor, is dissipated into heat; therefore, $3(i_1^2 r_1 + i_2^2 r_2) = 3e$ must be equal to the ordinate of our circle. If r_1 and r_2 are known, the point on the circle corresponding to this case can easily be found by trying.

[2] *Electric Transmission of Energy*, p. 304 and following.
[3] *L'Eclairage Electrique*, 1895.

A glance at our diagram shows us that we can attain at starting any running torque; but the starting current will always be equal, and never smaller, than the running current,[4] unless the motor is started under conditions, as higher or lower voltage, etc., different from those under load.

Efficiency.—The energy which flows into the motor neglecting hysteresis can be taken from the diagram. If e_1 is the impressed e. m. f., i_1 the current in each phase, then we have

$$(9) \ldots\ldots\ldots\ldots\ldots \mathfrak{E} = 3\, e_1\, i_1 \cos\phi$$

To obtain P we have to deduct the ohmic losses, the load losses, and the friction. Hysteresis and eddy currents may be taken into account, since they are practically constant at all loads, as though they were ohmic losses in a coil so placed upon the primary as to have no leakage at all, the energy wasted in this coil being equal to the loss through hysteresis and eddy currents. We have, then,

$$(10) \ldots\ldots\ldots\ldots P = 3\, e_1\, i_1 \cos\phi - 3\, i_1^2\, r_1 - 3\, i_2^2\, r_2 - F - Q$$

F being the friction loss in watts, Q the loss through hysteresis and eddy currents.

The efficiency η is

$$(11) \ldots\ldots\ldots\ldots \eta = \frac{P}{3\, e_1\, i_1 \cos\phi}$$

The most important formulæ for the design of the polyphase motor have thus been determined, and it will be useful to give them in the form of a table.

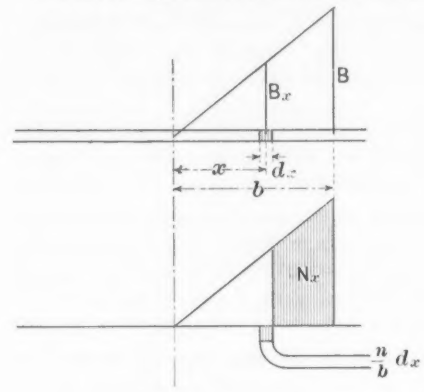


FIG. 8.

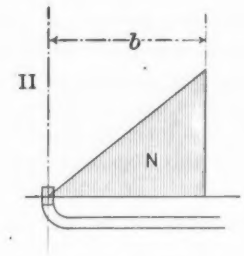


FIG. 9.

Maximum Power Factor—

$$(3) \ldots\ldots\ldots\ldots \cos\phi_0 = \frac{1}{2\sigma + 1}$$

Magnetic Field—

$$(5) \ldots\ldots\ldots\ldots e = 2 \cdot 12 \cdot \sim \cdot z_1 \cdot N \cdot 10^{-8} \text{ volts}.$$

Magnetizing Current—

$$(6) \ldots\ldots\ldots\ldots i_0 = \frac{B \cdot 1.6\,\triangle}{2n \cdot \sqrt{2}}$$

Slip—

$$(7) \ldots\ldots\ldots\ldots \frac{\sim_1}{r} = \frac{\sim_1 - \sim_2}{r_2}$$

$$\frac{\sim_1 - \sim_2}{\sim_1} = \frac{r_2}{r} = \frac{3\, i_2^2\, r_2}{P + 3\, i_2^2\, r_2}$$

Torque—

$$(8) \ldots\ldots\ldots\ldots 61.6 \cdot D_{mkg} = \frac{p}{\sim_1}\,(3\, i_2^2\, r_2 + P \text{ watts})$$

Impressed Energy—

$$(9) \ldots\ldots\ldots\ldots \mathfrak{E} = 3\, e_1\, i_1 \cos\phi$$

Output—

$$(10) \ldots\ldots\ldots\ldots P_{watts} = 3\, e_1\, i_1 \cos\phi - 3\, i_1^2\, r_1 - 3\, i_2^2\, r_2 - F - Q$$

Efficiency—

$$(11) \ldots\ldots\ldots\ldots \eta = \frac{P}{3\, e_1\, i_1 \cos\phi}$$

[4] Prof. Silvanus P. Thompson, "Polyphase Electric Currents," p. 213, says of a polyphase motor: "This motor starts under full load, taking less than full-load current." This is an impossible figment.

Elements of Illumination—XIV.

By Dr. Louis Bell.

GAS burners for ordinary illuminating gas are of three general types: flat flame, Argand and regenerative. The first is the most common and least efficient form. It has two general varieties, known respectively as the "fishtail" and "bat'swing." The former has a concave tip, usually of steatite or similar material, containing two minute round apertures, so inclined that the two little jets meet and flatten out crosswise into a wide flame. This form is now relatively little used save in dealing with special kinds of gas.

The "bat'swing" burner, with a dome-shaped tip, having a narrow slit for the gas jet, is the usual form employed with ordinary gas. Flat-flame burners work badly in point of efficiency unless of fairly large size. On ordinary gas of 14 to 17-cp nominal value on a 5-ft. burner, burners taking less than about 4 cubic ft. per hour are decidedly inefficient. A 4-ft. burner will give about 2.5 candles per foot, while a 5-ft. burner will give 2.75 to 3 candle-power per foot.

The Argand burners give considerably better results, their flames being enclosed and protected from draughts by a chimney, and the air supply being good the temperature of the flame is high and the

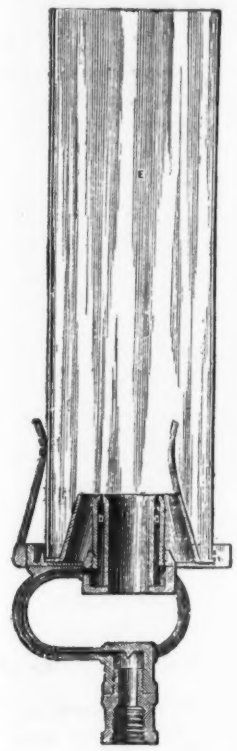


FIG. 1.—SECTION OF ARGAND BURNER.

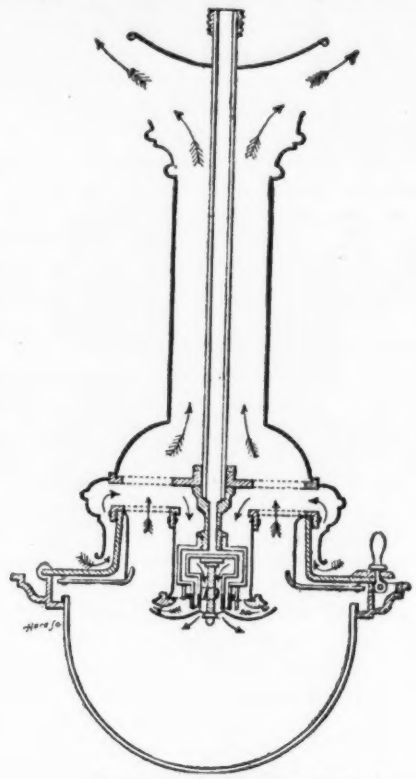


FIG. 2.—SECTION OF WENHAM BURNER.

light is whiter than in the flat-flame burners. The principle is familiar, the wick of an Argand lamp being replaced by a hollow ring of steatite connected with the supply, and perforated with tiny jet holes around the upper edge. Fig. 1 shows in section an Argand burner (Sugg's) of a standard make used in testing London gas. This burner uses 5 cubic feet per hour, and the annular chamber has 24 holes, each 0.045″ in diameter. The efficiency is a little better than that of the flat-flame burners, running, on good gas, from 3 to 3.5 candle-power per foot. The London legal standard gas is of 16 candle-power in this 5-ft. burner.

On rich gas the flat-flame burners, particularly the fishtail, work better than the Argand. It is better on very rich gas than is the bat'swing form. With ordinary qualities of gas, however, the Argand burner is vastly more satisfactory than the flat flame.

For very powerful burners the so-called regenerative forms are generally preferred. These are based on the general principle of heating both the gas and the air furnished for its combustion, prior to their reaching the flame. The burner proper is something like an inverted Argand, so arranged as to furnish a circular sheet of flame convex downward, and with, of course, a central cusp. Directly above the burner and strongly heated by the flame, are the air and gas passages. Fig. 2 shows in section the Wenham burner of this class. The arrows show the course of air and gas, the latter being burned just below the iron regenerative chamber and the products of combustion passing upwards through the upper shell of the lamp, and preferably to a ventilating flue. The globe below prevents the access of cold air, and the annular porcelain reflector surrounding the exit flue turns downward some useful light.

The Siemens regenerative burner, shown in Fig. 3, is arranged upon a similar plan and gives much the same effect. The regenerative burners of this class give a very brilliant yellow-white light with a generally hemispherical distribution downwards. They work best and most economically in the larger sizes, 100 to 200 candle-power, and must be placed near the ceiling to take the best advantage of their usual distribution. With gas of about 16-cp standard these regenerative burners consume only about 1 cubic foot per hour for 5 to 7 candle-power. Thus they are nearly twice as economical as the best Argand burners. Their chief disadvantage lies in the fact that to get this economy very powerful burners must be used of a size not always applicable. From this powerful centre of light a large amount of heat is thrown off, obviously less per candle-power of light than in any other gas burners, but, in the aggregate, large. Regenerative burners are well suited, however, to the illumination of large spaces, although at the present time the greater economy of the mantle burner has rather pushed the regenerative class into the background. Their light, nevertheless, is of a more desirable color than that given by the mantle burners.

The most recent and in some respects a very important addition to the list of flame illuminants is *acetylene*. This gas is a hydrocarbon having the formula $C_2 H_2$, which has been well known to chemists for many years, but which until recently has not been preparable by any convenient commercial process. It is a rather heavy gas, of evil odor somewhat reminiscent of garlic generally, and being very rich in carbon uncombined with oxygen (nearly 93 per cent by weight), it burns very brilliantly when properly supplied with air. Its flame is intensely bright, nearly white in color, and for the light given vitiates the air in comparatively small degree.

Acetylene is made in practice from calcic carbide ($Ca\ C_2$), a chemical product prepared by subjecting a mixture of powdered lime and carbon (coke) to the heat of the electric furnace. By this means it can be prepared readily in quantity at moderate cost. The acetylene is made from the calcic carbide by treating it with water, lime and acetylene being the results of the reaction, which, in chemical terms, is as follows:

$$Ca\ C_2 + 2\ H_2\ O = Ca\ (O\ H)_2 + C_2\ H_2.$$

Commercial calcic carbide is far from being chemically pure, so that the acetylene prepared from it contains various impurities and is neither in quantity nor quality just what the equation would indicate. The carbide is extremely hygroscopic and hence not very easy to transport or keep, and the upshot of this property and the inherent impurities is that the practical yield of acetylene is only about 4.6 to 5.0 cubic feet per pound of carbide, 4.75 cubic feet being an extremely good average unless the work is on a large scale. In theory the yield should be nearly 5.5 cubic feet per pound. The gaseous impurities are quite varied and by no means uniform, but the most objectionable ones may be removed by passing the gas in fine bubbles through water. If the gas is being prepared on a large scale it can readily be purified.

Acetylene has the disadvantage of being somewhat unstable. It forms direct compounds with certain metals, notably copper, these compounds being known as acetylides, and being themselves so unstable as to be easily explosive. Acetylene should be therefore kept out of contact with copper or brass in storage and even in fixtures. The gas itself is easily dissociated with evolution of heat into carbon and hydrogen, and hence may be inherently explosive under certain conditions, fortunately not common.

Fortunately at atmospheric pressure or at such small increased pressures as are employed in the distribution of gas, acetylene, unmixed with air cannot be exploded by any means ordinarily at hand.

Above a pressure of about two atmospheres, acetylene is readily explosive from high heat or a spark or flame, and grows steadily in explosive violence as the initial pressure rises, until when liquified it detonates with tremendous power if ignited. At ordinary temperatures it can be liquified at a pressure of about 80 atmospheres, and it has been proposed to transport and store it in this form. But although even when liquified it will not explode from mechanical shock, it is in this condition an explosive of the same order of violence as gun-cotton or nitro-glycerine, and should be treated as such.

Mixtures of acetylene and air explode violently just as do mixtures of illuminating gas and air. The former begins to explode rather than merely burn when the mixture is about one volume of acetylene to

three of air, detonates most violently with about nine volumes of air, and ceases to explode with twenty volumes of air. Ordinary coal gas begins to explode when mixed with 3 volumes of air, reaches a maximum of violence with about 5 to 6 volumes, and ceases to explode with eleven volumes. Of the two gases, the acetylene is rather the more violently explosive when mixed with air, and it becomes explosive while the mixture is much leaner. The difference is not of great practical moment, however.

As regards its poisonous properties, acetylene seems to be somewhat less dangerous than coal gas and very much less dangerous than water gas. Properly speaking, acetylene is very feebly poisonous when pure, and has such an outrageous smell that the slightest leak attracts attention. Some early experiments showed highly toxic properties, but these have not been fairly confirmed, and may have been due to impurities in the gas, perhaps phosphorine, which is a violent poison.

The calcium carbide from which the acetylene is prepared is so hygroscopic and gives off the gas so freely that it has to be stored with great care on account of possible danger from fire. Fire underwriters are generally united in forbidding the use or storage of liquid or compressed acetylene, or the storage of any but trivial amounts of calcic carbide (a few pounds) except in detached fireproof buildings.

Acetylene is, when properly burned, a magnificent illuminant. It will not work in ordinary burners, for unless very liberally supplied with air it is so rich in carbon as to burn with a smoky flame and deposit of soot. It must actually be mixed with air at the burner in order to be properly consumed. When so utilized its illuminating power is very great. The various experiments are not closely concordant, but they unite in indicating an illuminating power of 35 to 45 candle-hours per cubic foot, according to the capacity of the burner, the large burners, as usual, working the more economically.

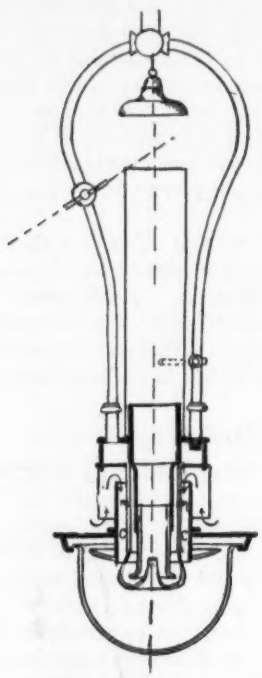


FIG. 3.—SECTION OF SIEMENS' REGENERATIVE BURNER.

FIG. 4.—ACETYLENE BURNER.

This means that the acetylene has about 15 times the illuminating power of a good quality of ordinary illuminating gas when burned in ordinary burners. It will, consequently, give about 8 to 10 times more light per cubic foot than gas in a regenerative burner, and, it may be mentioned, about 3 to 4 times more light than gas in a mantle (Welsbach) burner.

Fig. 4 shows a common standard form of acetylene burner, intended to consume about 0:5 cubic foot per hour. It is a duplex form akin in its production of flame to a common fishtail. Each of the two burners is formed with a lava tip having a slight constriction close to its point. In this is the central round aperture for the gas, and just ahead of it four lateral apertures for the air supply. The acetylene and air mix just in front of the constriction and the two burners unite their jets to form a small, flat flame. It is in effect a pair of tiny Bunsen burners inclined to produce a fishtail jet. Larger acetylene burners are worked on a similar principle, all having the air supply passages characteristic of the Bunsen burner. Too great air supply for the acetylene gives the ordinary colorless Bunsen flame, but on reducing the amount the acetylene burns with a singularly white, brilliant and steady flame.

Of acetylene generators designed automatically to supply gas at constant pressure from the calcic carbide the name is legion. A vast majority of those in use at present are of rather small capacity, being designed for a few lights locally or as portable apparatus for lamps used for projection. Generators on a large scale have hardly come into use, and the problems of continuous generation have consequently not been forced into prominence. A very excellent type of the small generator is shown in Fig. 5, a form devised by d'Arsonval. It consists of a small gasometer with suitable connections for taking off the gas and drawing off the water. The bell of the gasometer is furnished at the top with a large aperture closed by a water seal. Through this is introduced a deep iron wire basket containing the charge of carbide. The acetylene is generated very steadily after the apparatus gets to working and the pressure is quite uniform. The water in the gasometer of the d'Arsonval machine is covered by a layer of oil, which serves an important purpose. When one ceases using the gas the bell rises, and as the carbide basket rises out of the water the oil coats it and displaces the water, checking further evolution of gas. The oil also checks evaporation, so that there is no slow evolution of gas from the absorption of aqueous vapor. As to the value of acetylene, it is evidently worth, say, 15 times as much per cubic foot as gas burned in ordinary burners, or 3 to 4 times as much as gas, assuming it to be burned in Welsbach burners.

Now one ton of calcic carbide of high quality, efficiently used, will produce nearly 10,000 cu. ft. of acetylene, equal in illuminating value to 150,000 cu. ft. of gas in the one case, or 30,000 to 40,000 cu. ft. in the other.

The cost of the calcic carbide is a very uncertain quantity at present. The best authorities bring the manufacturing cost on a large scale and under very favorable circumstances somewhere between $30 and $40 per ton. It is doubtful if any finds its way into the hands of bona fide users at less than $100 per ton, and the current price in small lots is much higher, and naturally so, by reason of troublesome storage and the cost of transportation. Adding the necessary allowance for producing the gas from the carbide, and it is at once evident that the cost of lighting by acetylene falls below that of lighting by ordinary gas in ordinary burners at the common price of $1 to $1.50 per 1000 ft.

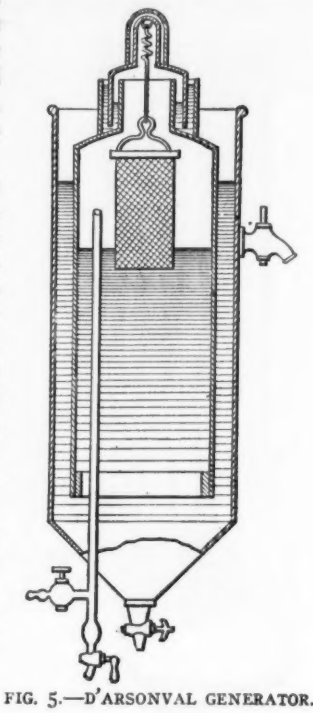


FIG. 5.—D'ARSONVAL GENERATOR.

It is equally evident that it considerably exceeds the cost of gas lighting by Welsbach burners. There seems to be small chance of its coming into general competition with either at present. Its cost of production and distribution does not render it attractive commercially for ordinary conditions. Nevertheless, it is for use in isolated places one of the very best and most practical illuminants, for it is fairly cheap, easily made and gives a light not surpassed in quality by any known artificial illuminant. It is peculiarly well adapted for temporary and portable use, giving as it does a very brilliant and steady light, well suited for use with reflectors and projecting apparatus, admirable in color, and very easy of operation.

Baths for Telephonists.

It is stated from Paris that reforms in the postal and telegraph departments are of frequent occurrence. M. Mougeot, the Under Secretary, being absent for the benefit of his health, M. Millerand, who is supreme chief of the post office, has taken a hand at improvements. His watchful eye noticed the pale visages of the telephone girls. A remedy was found in providing them with free shower baths. The central telephone office was fitted a few days ago with the latest pattern of this invigorating appliance. Facetious journalists have taken the opportunity of cracking a few more jokes at the expense of "les demoiselles du téléphone," whose absent-minded way of attending to business is proverbial. The hope is generally expressed that the timely subjection to cooling sprays will infuse some vigor into the young ladies at the telephone exchanges and thus save much wear and tear on the wires and the nerves of the general public. It may be noted that in America the "hello girl" has long enjoyed the comfort here referred to, in many Bell telephone exchanges.

In The Power House of the Paris Exposition.

IT has been remarked by some visiting engineers to the Paris Exposition that American steam engines were not represented. It is true that there are not many. At Vincennes, the Ball engine plant, already described in these pages, is the only example of an engine built in the United States, and it is used to furnish electric current for power and lighting. Exception may, however, be made in the case of some excellent compressor engines built by the Ingersoll-Sergeant Company. For electric power transmission, there is, however, an engine-generator set which is distinctly American, although built in France. This is the E. P. Allis engine and Thomson-Houston alternator in the French power house of Champ de Mars. The engine is built from American designs by the Société Française de Constructions Mécaniques, and the alternator comes from the shops of the Postel-Vinay Company, the manufacturers for the French Thomson-Houston Company, who in turn may be described as representing the General Electric Company; Mr. Ernst Thurnauer, the able and energetic chief director, is well known in the United States. The engine is of the vertical type, compound condensing, with cranks at each end of the main shaft, and carrying the alternator field and flywheel in the middle. The cylinders are 32 ins. and 68 ins. in diameter, for high and low pressure respectively, and the stroke is 4 ft. Reynolds-Corliss valve gear is used. The governor controls the admission of steam, and a safety device is added which cuts off the steam entirely from the high-pressure cylinder in case the governor should for any reason fail to act if the engine began to race. Steady running is guaranteed by the flywheel, which is 24 ft. in diameter and weighs about 70 tons. Taking steam at a pressure of about 130 pounds, as here supplied, and running at 75 r. p. m., the engine develops about 1750 horsepower. The alternator is rated at 1000 kilowatts, and furnishes current for Exposition purposes at 5000 to 5500 volts, three-phase. The outside diameter of the machine is but 15 ft., and width 3 ft., so that the size is small for the output, and the temperature nevertheless does not rise more than 40 degs. C. above the surrounding air at continuous full load. An overload of 25 per cent may be carried without any trouble for over two hours, and a 50 per cent overload for five minutes. At full load an efficiency of 95.5 per cent is obtained, and at half load 94 per cent. The exciting current at no load is 12 kilowatts, which is but 1.2 per cent of the normal output. The revolving field has 40 poles, and at 75 r. p. m. gives a frequency of 25 periods. The field magnets are built up of laminated steel and are securely bolted to a steel flywheel; the winding is in the form of copper ribbon, 90 sq. mm. in cross section, wound on edge to give rapid cooling. Exciting current at 125 volts is brought from an independent machine. The armature frame is in two parts, bolted together at the horizontal centre line, and carries the laminated core between two sets of plates bearing against shoulders on the frame. There are 120 slots and 60 coils, each having 25 turns of wire 55 sq. mm. in cross section. Close

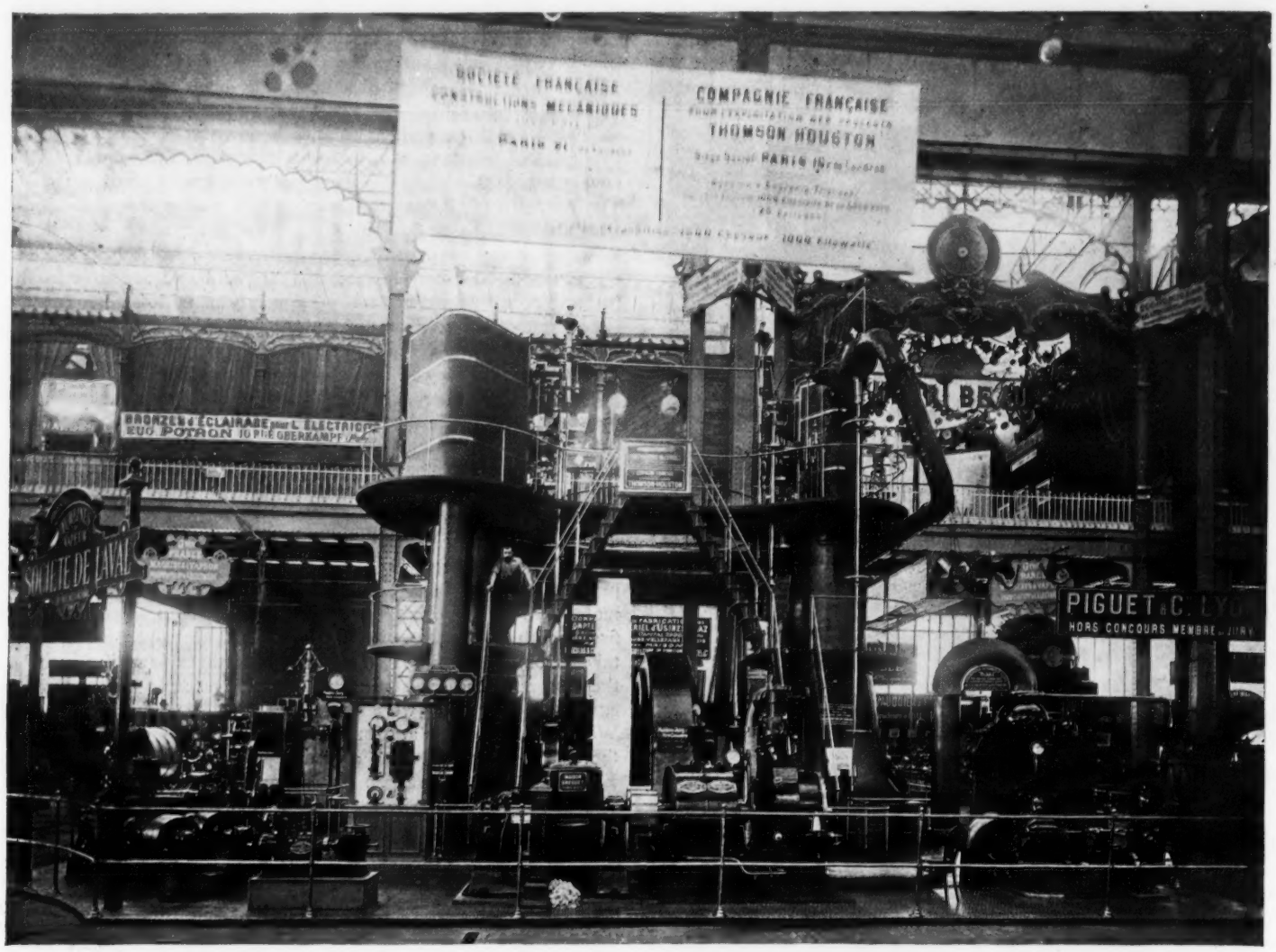


FIG. 1.—ALLIS 1750-HP ENGINE AND THOMSON-HOUSTON ALTERNATOR. FRENCH POWER HOUSE.

adjustment of the armature to the field is provided by means of screws on the base plates, allowing lateral movement at right angles to the shaft, and a slight amount of vertical movement by bolts passing through the feet of the frame. The armature may also be moved parallel to the shaft a sufficient distance to permit inspection of the field magnets.

In front of the Thomson-Houston alternator, in the engraving, will be seen the steam turbine and dynamos furnished by the DeLaval Company and Breguet, of Paris. There are two of these units in the French power house, close together. They are essentially very high speed machines, the turbine shaft running in this case at 9000 r. p. m., and the twin dynamos at 780 revolutions, driven by special gears for the reduction in speed required. The full steam pressure of the mains is used, and the steam is supplied to the wheel by eight jets, four being of the conical type for use when a condenser is employed, and two of cylindrical type for free exhaust, while two have spring counterbalanced action, opening only when the load exceeds a certain

point. Blake independent condensers are used. The two Breguet dynamos are each of 100 kilowatts capacity and furnish current at 125 volts. They are used to balance the lighting circuits of the Exposition. In order to bring the two shafts of the twin dynamos close together, the salient-consequent pole-type of machine is adopted, there being four poles and field coils on the upper and lower ones. Cast steel is used for the field frame, and it is made in two parts, bolted together and considerably hollowed out within the salient poles. The bore of the field is 22⅜ ins. A slotted armature is used, having 60 slots. The winding is made up of copper bars 16 mm. deep by 2.5 mm. wide, four bars to each slot. Specially light brushes have been designed for these machines, on account of the high speed of rotation. Small carbon blocks are held at the end of a flexible sheet-metal clamp, contact at the commutator surface being assured by the pressure of a threefold leaf spring secured to the brush-holder and holding down the carbon.

In one of the corners of the foreign power house, under the gallery, is an interesting machine built by Electricité et Hydraulique, a French company, with shops in Belgium also. This is an alternator direct connected to a vertical engine by the Nuremberg Engine Company. The chief point of interest is the means adopted for moving

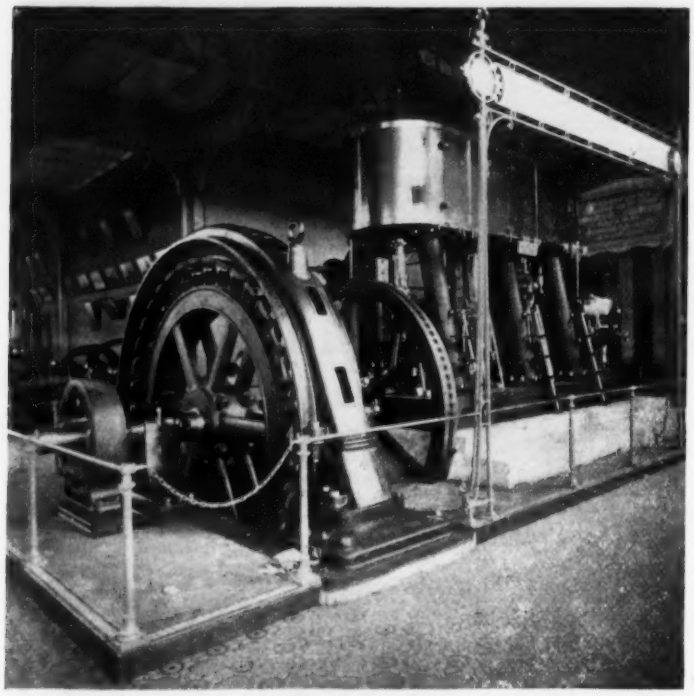


FIG 2.—NUREMBERG ENGINE AND ELECTRICITÉ ET HYDRAULIQUE ALTERNATOR.

the armature frame, for inspection or repair of any part ordinarily out of reach. The feet of the frame rest on plates bolted to the foundations; but, when it is desired to turn the frame, that is loosened from the plates and these are slid away, allowing the armature to rest on wooden wedges driven in between the face of the armature core and the field poles. The removal of the supporting plates discloses openings in the foundations of sufficient size to permit of the feet of the frame passing through when the field and armature, thus coupled, are rotated. For the purpose of removing armature coils, corresponding field poles may be temporarily withdrawn. This arrangement for turning over the armature may be considered one of those so-called practical ideas which are not frequently found in foreign-built machines. The firm of Brown, Boveri & Co. have, as illustrated recently in these Exposition articles, designed alternators of somewhat the same pattern as this, but the armature frame is supported on heavy radial arms meeting in hubs on either side, these being held on central bearings and thus permitting the rotation of the frame when the holding-down bolts are removed. Such a design, however, it is urged, involves greater complication and considerable weight, besides rendering the field less accessible than in the open design shown by the competing makers.

PARIS EXPOSITION NOTES.

THE FÊTES AT VINCENNES have proved successful in attracting much greater crowds to those distant sections of the Exposition than were seen there in the earlier days. Oct. 30 is set for an automobile fête, in which prizes to the extent of 2000 francs will be awarded, and Sunday, Nov. 4, will be celebrated by a night fête with illuminated boat parades on the lake which lies close to the buildings. On the Champ de Mars there is to be a Transportation Festival on the last day of October, with a historical parade in which will figure many of the actual vehicles of olden days that are now on exhibition in the Transportation Building. It is noteworthy that the grounds at the Invalides are never used for fêtes, perhaps in order that they may be kept in better condition.

ENTRANCES.—The Administration has issued a statement as to the total number of entrances up to Oct. 4. As including both paying and free entrances, the total is 42,273,708, and the actual number of tickets taken in is 37,839,899.

MR. H. G. REIST, of the General Electric Company, Schenectady, N. Y., is in Paris for a few days to see the developments in electrical engineering as shown in the Exposition, but leaves for America before the close. Mr. C. H. Veeder, formerly connected with the Thomson-Houston Company, has also visited the headquarters of the ELECTRICAL WORLD AND ENGINEER in Electricity Palace.

TRANSPORTATION.—With the shortening days and the cool evenings the moving sidewalk is less patronized towards the close of the day, so that it has been decided to shut it down at 9 o'clock, except on Fridays and Sundays, which, being fête days, draw larger crowds than other days, and justify running the sidewalk until 10:30 p. m. The narrow-gauge third-rail road, which makes the circuit of the Invalides and Champ de Mars alongside of the moving sidewalk, does a large business on days of special attractions, and sometimes trains are run with four cars instead of three, and still are crowded with passengers at a five-cent fare, who mostly make less than one complete circle of the road; and therefore are not on the cars as much as twelve minutes, which is the time consumed on one trip. This is ideal "short tripping," viewed from an income standpoint.

THE INCANDESCENT LAMP SIGN above the Westinghouse building for the sub-station is supplied with current from the 550-volt railway circuit, and its brilliancy remains constant because the e. m. f. hardly varies. The rotary converter which runs the railway has, of course, a constant speed, and the field is compound wound. The incoming current is three-phase, but one of the wires may be disconnected at the switchboard and the motor be run as a single-phase machine when once it is in synchronism, without occasioning more than a 10 per cent drop in voltage. With all the field excitation cut off the motor will still run, the voltage drop being about 25 per cent. The first month of the Exposition the 5000-volt three-phase current was taken from the Asnières station in the northern part of the city, but the motors in the sub-station ran just as smoothly with a "foreign" current as when they were afterwards supplied with power from the Westinghouse station at Moulineaux. In the early part of this month the engines were tested on a load supplied at the sub-station in the Exposition. There are two sets of main cables from the power station, one being ordinarily used to carry current and the other held in reserve. On the occasion mentioned, one of the 850 horse-power machines was loaded by sending the current through a series of twenty barrels of acidulated water, the terminals being iron plates. Tests on other occasions have been made of the large machines by running one from the three-phase mains and driving the other on the continuous current end from the corresponding generator of the first set, and delivering the three-phase current from the second set back into the line. By this means the actual load taken from the station was only that used as heat and friction in the two machines. In such tests the sidewalk and railroad were run, as usual, from the two rotaries.

THE OTIS ELEVATORS in the National Pavilion are run by current tapped from the sidewalk circuit close by. Since it was found that it was not advisable to have the sidewalk motors all in parallel across a 500-volt circuit on account of the rather high speed resulting, they were connected two in series, giving a potential of about 250 volts across the terminals. The motors for the elevators in the National Pavilion are wound for 220 volts, and are connected in between two sidewalk motors and the outer main.

Open Cars All Winter.

The Union Traction Company of Philadelphia promises to run open cars, one in five, all winter long, with no restrictions as to smoking. In the summer smoking is permitted there on only the last three seats of the open cars.

The Alternating Current Arc *—I.

BY C. WILER.

THE physical nature of the open or enclosed alternating arc has been a salient factor; this, however, is the key for many phenomena of the arc. If we establish an arc between carbon electrodes, we find that the arc voltage increases with the length of the arc; if we keep the arc length constant and increase the current the arc voltage begins to decrease with the current. The apparent resistance of the arc is therefore unlike a wire resistance, which requires a higher e. m. f. with an increase in current, but it decreases with increasing current, so that an arc on a constant potential circuit takes a constantly increasing current. In order to offset this tendency, a steadying device is required, which does not depend for its resistance upon the current, and which will thereby fulfill the fundamental requisite for the application of the arc to lighting purposes.

On a constant potential circuit a series resistance or series reactance will render the arc stable. The larger the resistance, the less the variation in current and the steadier the arc. On a constant current circuit, where the arcs are connected in series and the main regulating coils offer no perceptible impedance, the dynamo or transformer decreases the terminal pressure with increasing current. The more drooping the characteristic or the relation of current and e. m. f. on the dynamo or transformer for either fixed brush position, fixed position of movable coil or core, the steadier the arcs.

The resistance of a stable direct current arc is of constant value for any particular current. The resistance of the alternating arc varies with the current. During the first part of the positive half of the cycle the resistance drops from its maximum value at zero current to its minimum value at maximum current and rises again during the second part, so that the wave form of the resistance will describe during one-half cycle of the current a complete cycle, and the resistance of the arc will pulsate at the rate double the frequency of the current.

Considering instantaneous values of the alternating arc, we may take it for granted that the law of the direct current arc can be applied to them. The transformation of electricity into light is certainly not different for a current of momentary value from that for a current of continuous value. Hence, during the positive part of the cycle the upper carbon will be the seat of the light. It has been shown by exploring the distribution of potential in the direct current arc that the larger part of the energy is expended at the crater of the arc, producing there the highest temperature, while the smaller part is expended along the vapor column and at the negative carbon tip. For the low values of the impressed alternating e. m. f. an arc cannot be formed or maintained between solid carbons, if they are separated for the full arc length corresponding with the normal voltage. The available voltage is not sufficient to overcome the high resistance at the positive carbon tip. The current will therefore be zero for the low values of the impressed e. m. f. It is only for the higher values that the current will find its path through the arc to the negative carbon. After the current and e. m. f. have reached their maximum values, the current will gradually drop and either fall off very abruptly near the zero line or cause a rupturing of the arc. As soon as the negative cycle starts, a shifting of polarity will take place, so that the lower carbon becomes positive and the upper negative, whereupon the same cyclic variation will be repeated. During the larger part of the cycle the current is zero or very small and the arc tends to extinguish. This action takes place when an alternating arc is to be maintained between solid high voltage electrodes; it clearly demonstrates that the attempts which have been made from time to time to operate open alternating current arcs with solid carbons conflicted in their very beginning with the laws of nature, and it shows also that the enclosed arc between solid carbons, which has a much larger resistance in the vapor column than the open arc, is bound to be a failure.

The effect of the cored carbon upon the alternating arc can be explained by comparing it with a liquid, whose resistance is lowered by the insertion of salts, and whose transitional resistance at the electrodes is changing therewith. For low voltage carbons, whose cores contain the salts of sodium or potassium, a large e. m. f. is not required to overcome the resistance at the crater, as the core and the surrounding gases of high conductivity will not then offer a very high resistance to a current of low value, and they will offer but a small resistance to a current of high value. The resistance of the arc under these conditions is so modified that it acts more like an ohmic resistance and the current and voltage rise and fall in unison. This has been recognized for several years, and the success of open alternating arc lamps in Europe is due to the high grade of cored carbons, which meet the inherent defects in the arc. It is apparent that an open alternating current arc between two cored carbons will not require a large amount of steadying resistance on account of the characteristic just mentioned. It is surprising, however, that only a short time ago Blondel stated at the Paris Congress: "The alternating current arc requires less stability resistance because of the greater sensibility of its mechanism under influence of vibration." (*West. Elec.*, Vol. XXVII., No. 13). Whatever resistance is required by an open alternating current arc between cored carbons is necessary at the moment, when the current is near its zero value, when the polarity of the carbon reverses and the arc stream changes its direction. It is a matter of experience, and also borne out by theoretical investigations, that this is better accomplished by a small inductive resistance than by an ohmic resistance. The e. m. f. of the latter will vanish with the current, while the leading e. m. f. of the former will be ready to help the lagging current over the zero point or the dead centre of the arc. It is here that the effect of what may be termed the "momentum of the arc," i. e., of the frequency, becomes plainly visible. The higher the frequency, the quicker the change in the polarity of the carbons, the shorter the time during which the current is of small value and the carbons and the arc can decrease their temperature and by their increasing resistance oppose the establishment of an arc. We might expect from the foregoing that a low frequency arc is less efficient than a high frequency one; but Blondel has shown that for open alternating current arcs the opposite is the case. (ELEC. WORLD AND ENG., Vol. XXIX., "Luminous Efficiency of the Alternating Current Arc.") He attributes this "to the greater distance between the carbon points that is realized for the same voltage at high frequencies."

The effect of the frequency and the conductivity of the arc stream is of the greatest importance for the starting and controlling of arc lamps, and many problems met in practice can be considered and solved accordingly.

*A paper read before the Chicago Electrical Association.

New York Electrical Society.

The New York Electrical Society held its first regular meeting of the season at the College of the City of New York on Tuesday, Oct. 30, when, in spite of the inclemency of the weather, a good attendance assembled to listen to various addresses on the electrical features of the Paris Exposition and the work of the Electrical Congress. Mr. Carl Hering, president of the American Institute of Electrical Engineers, was the first speaker, and delivered an admirable address on the electrical features and novelties of the great show, making many cogent criticisms in passing, on the features of merit or difference, in connection with the leading European and American exhibits. His remarks were followed by the exhibition of some very interesting and handsome lantern slides covering not only the technical features, but some of the more artistic and spectacular portions of the Exhibition. He was followed by Dr. A .E. Kennelly, who addressed his remarks more particularly to the modern steam turbine, as illustrated by the "Turbinia," which was exhibited on the Seine within the Exposition enclosure. He also took up and described in detail the mechanism of the moving sidewalk, his remarks being again accompanied by lantern slides. He took a very hopeful view of the future of the steam turbine, both ashore and afloat. The third speaker was Mr. C. O. Mailloux, who gave a most entertaining description of the whole work of the Electrical Congress, and of the manner in which the American delegates succeeded in carrying through their programme with regard to the new units which were adopted, or, rather, approved officially. Mr. Mailloux's references to the manner in which the members of the society had taken an active part in this work, elicited hearty applause. At the close of the meeting, as some little recognition of the courtesy of Messrs. Hering and Kennelly in coming before the society and entertaining its members so instructively, they were elected honorary members by a hearty and unanimous vote of thanks. Following up the admirable work done during the two years of his administration by President Dunn, the society has started out on its present season with renewed hope and vigor, and Secretary Guy was able to present a list of twenty-seven candidates for membership, who were duly elected. Names are given below. It was also announced that during the present month Mr. Steinmetz will deliver a lecture before the society on "Alternating Curent Work," and that in December, Dr. Sheldon will deliver an address on "Electrical Measurements of Precision."

The following were elected to membership: Chas. O. Gunther, Jas. Alvin Wynkoop, Frederick L. Bunton, Rumsey W. Scott, R. A. Byrns, Frederick A. Scheffler, C. E. Corrigan, Arthur Stanley Riggs, Chas. Gebhard, Joseph Vogelmann, Felix J. Rush, Wm. F. Harra, H. A. Eddelman, W. W. Todenworth, Jas. F. Gilespie, Peter Bay, H. McL. Harding, Clarence L. Healy, F. A. Stratton, A. B. See, Chas. Hodge, Hugh W. Wilson, Chas. Robbins, H. B. Proal, all of New York, and E. L. C. Hegeman, Livingston, S. I.; William F. Hunt, West New Brighton, N. Y.; A. S. Clift, Ampere, N. J.

Honorary members: Carl Hering and Dr. A. E. Kennelly, Philadelphia, Pa.

The following committees have been appointed for the ensuing season: Finance—Arthur Williams (chairman); C. O. Baker, Jr. Papers and Meetings—W. C. Burton (chairman); S. L. Coles. Membership—F. V. Henshaw (chairman); S. L. Coles. Constitution and By-Laws—Arthur Williams (chairman); H. A. Sinclair, G. H. Guy.

Wireless Telegraphy.

On the evening of Oct. 31 a lecture was given before the Western Society of Engineers, at Chicago, on "Wireless Telegraphy," by Warren S. Johnson, of Milwaukee. Mr. Johnson is now connected with the American Wireless Telegraph Company, of Milwaukee, and has been engaged in the perfection of apparatus in that line for some time past. The lecture was necessarily somewhat popular and historical, being a review of the theory of the subject, and going over the progress made, Mr. Johnson dating from the wireless telephony experiments of Dolbear to the present time. The most interesting part of the lecture to those already familiar with the subject was the description and demonstration of the working of the new Johnson decoherer. This apparatus consists of two coherers connected in parallel. In connection with these, there is a tiny pneumatic engine which has the exhaust from one end of its cylinder connected to one coherer and the exhaust from the other end of its cylinder connected to the other coherer in such a way that the air blast of the exhaust will cause the filings in each coherer to decohere alternately as fast as the exhausts act on their respective coherers. The result is manifestly this, that the impulses coming in and causing the coherers to conduct will give a signal through one coherer or the other as long as each impulse lasts; but as soon as the impulse ceases, the exhausts break the coherer circuit immediately. This decoherer apparatus was on exhibition and the demonstration showed a very satisfactory working. The air engine used was exceedingly small and would run for hours from a tank of air which was filled by hand in a minute. Mr. Johnson, whose work several years ago in automatic temperature regulating systems is known the country over, has for some time past been giving his attention to what he calls "micro-pneumatics," that is, the application of compressed air to very small uses, a field in which little has been done, but which is full of interesting possibilities.

Election Returns by Telephone in New York.

The New York Telephone Company made very complete arrangements for distributing election returns over the telephone system of Manhattan and the Bronx and Westchester County. The American Telephone & Telegraph Company (Long Distance) collected the returns from the various local telephone companies all over the country and compiled summarized bulletins which were turned over to the New York Telephone Company for distribution. In Westchester County the New York Telephone Company collected information for that district, as well as distributing the returns for the whole country. For receiving and distributing the statistics a large number of special telephone sets were fitted up in the new operating room on the ninth floor of the Cortlandt Street Telephone Building, which has only just been completed, and is not yet equipped with the monster switchboard building for it. On one side of the room the returns from all over the country came in, and on the other side they were transmitted to the various central offices throughout Manhattan, the Bronx and Westchester, and to the various hotels, clubs and other public places that had applied for the special service.

Any telephone subscriber who desired information regarding the progress of the election, on notifying the operator, was connected with one of a hundred special telephone stations that had been equipped in the Thirty-eighth Street Telephone Building for the purpose of answering such inquiries. These special stations were sufficient to answer all inquires from telephone subscribers, as the conversations were necessarily brief, but provision was made so that should all the hundred become "busy" at once the overflow could be handled in the exchanges, which were all supplied with the returns.

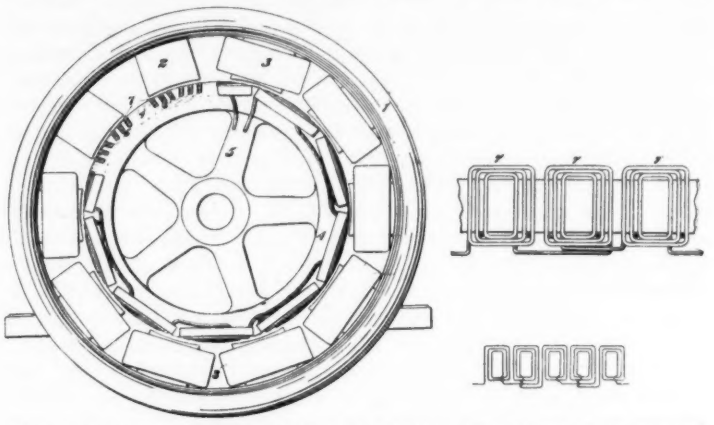
In thirty-two of the principal hotels and clubs in Manhattan the New York Telephone Company provided members of its own staff for receiving and tabulating the bulletins as they came in, and the returns were also supplied to thirty-five of the country clubs, associations and hotels of Westchester County.

This very complete service was supplied entirely gratuitously by the New York Telephone Company, which, realizing the excellent facilities its system affords for quickly and effectively distributing the returns, has done similar work at each election for several years past. The special services of some four hundred employees of all departments were required apart from the regular complement of operators and others at their ordinary posts.

Singlephase and Polyphase Motor Development.

A group of patents, five in number, has just been issued to Mr. B. G. Lamme, of Pittsburg, on various improvements in motors and power distribution. One of these on single-phase motors is illustrated in Figs. 1, 2 and 3. The field magnet frame 1, pole-pieces 2, and field magnet coils 3 are of the usual or any well-known construction. The armature core 4 is mounted upon a spider 5 and is provided with a plurality of sets or groups of parallel slots 6, there being one such group for each pole. The slots of each group corresponding to each pole are parallel to each other and to a plane including the armature axis and the middle point of the segment of the armature core surrounded by the group of coils 7, located in the slots 6.

In cases where the armature winding is made up of wire-wound coils, as indicated in Figs. 1 and 2, the coils are separately wound upon suitable molds or forms, there being as many sizes of coils as there are pairs of slots in each group, so that the coils may be readily



FIGS. 1, 2 AND 3.—IMPROVEMENTS IN MOTORS AND POWER DISTRIBUTION.

inserted in the appropriate slots or channels without bending and substantially without the exertion of pressure, the terminals of these several coils of each group being subsequently connected together, so that the entire portion of the winding for each pole constitutes in effect a single coil and the several coils being connected in series around the armature. In cases where a strap-winding is employed, each coil for each group corresponding to a pole is bent or coiled into suitable shape for insertion in the slots and suitably insulated, this form being diagrammatically shown in Fig. 3. These coils having the several turns of different lengths may then be inserted in the proper slots or channels and their ends suitably connected to make a single series winding for the entire armature.

The number of slots or channels per pole may obviously be varied in accordance with the size and output of the machine and the spaces between the slots or channels may also be varied from what is shown. Mr. Lamme has a considerable width of core space included within the inner coil or turn of each group and a comparatively narrow space between the adjacent sides of the outer coils or turns of adjacent groups in order that all of the conductors at the adjacent sides of each two adjacent groups of coils may be under corresponding field magnet pole-pieces at the same time, thus insuring more satisfactory results than would otherwise be attained.

In another patent Mr. Lamme aims to provide a motor which may be operated economically at widely-varying speeds without depending wholly or even mainly upon variation in the field magnet excitation of the motor. He makes a motor with an armature having two windings and two commutators, the lengths of the two windings having approximately the ratio of 40 to 100, and by means of suitable switching devices to connect the two windings in series for one rate of speed, to cut the shorter of the two windings out of circuit for a higher speed, to connect the windings in opposition for a still higher rate, and to cut the longer winding out of circuit for maximum speed, it being assumed that the e. m. f .supplied to the armature remains substantially constant. He has found by computation and experiment that the ratio of 40 to 100 in the lengths of the two armature windings insures an increase and decrease in speed by substantially equal steps, or as nearly equal as it is possible to secure by changing the relation and connection of the windings in circuit in the manner described. Of course this ratio need not be exact; but a variation of a comparatively few turns either way, so that the ratio is 35 to 100 or 45 to 100, for example, serves to make the steps widely unequal. If a more gradual variation in speed than that which is possible of attainment by the means described is desired, the field magnet excitation may be varied between the steps described by means of a field rheostat, in the usual way.

In his improvement on polyphase induction motors, Mr. Lamme employs an independent winding for each rotating field and locates the winding for producing the field having the maximum number of poles where the tendency to produce injurious local magnetic circuits is least, and the winding for producing the field having the minimum number of poles where the tendency to produce injurious local magnetic circuits is greatest. If more than two windings are employed, he locates the intermediate winding or windings at intermediate points in accordance with the conditions.

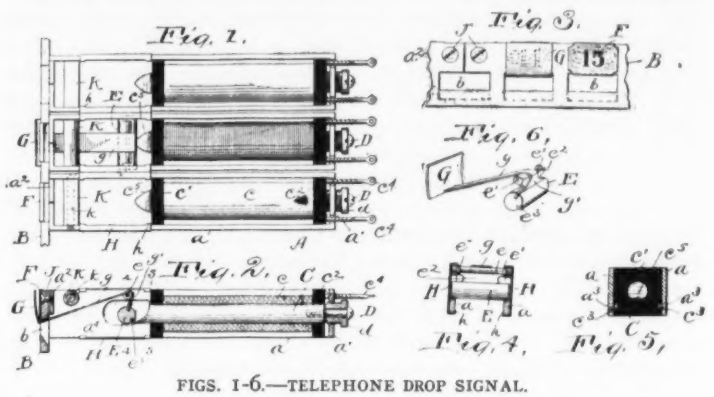
In the two remaining patents, one discloses a plan for the transformation of alternating into direct current, with the aid of batteries. In the scheme shown, when the battery or batteries are receiving a maximum amount of current and are exerting a minimum counter e. f. m. the series winding of the rotary converter will exercise its maximum magnetizing effect, and consequently the resulting magnetic field of the rotary converter will be a minimum. As the charging operation progresses, less current will flow through the series coils and more through the shunt coils of the converter, and this serves to advance the current with reference to the impressed e. m. f. in the alternating current circuits supplying the transformer, and thus increases the direct-current e. m. f. This increase in resultant magnetization and consequent adjustment of the phase between the current and impressed e. m. f. will increase as the charging of the batteries progresses, and consequently the direct current e. m. f. will be gradually decreased as demanded by the condition of the batteries.

The last patent of the batch covers means for producing a constant torque with variable speed in induction motors. It has been proposed prior to this to secure an approximately constant torque with variable speed in induction motors by a variation in the watts of the secondary member obtained by varying the resistance of the circuits of the secondary member of the motor as the speed varies. In lieu of this means Mr. Lamme proposes to vary the watts in circuits of the secondary member, and consequently the slip of the motor, by varying the current of an inductively-related circuit that contains an invariable resistance.

Drop Signal for Telephone Switchboard.

Mr. C. H. North, of Cleveland, Ohio, has received three patents on telephonic improvements and has assigned them to the company bearing his name. One of them is on a magneto generator, with special automatic means for opening a shunt circuit normally around the armature coils, and another is a hook arm relieved of all electrical cooperation with the switch, so that the free mechanical movement of the lever on its pivot does not interfere with an excellent electrical connection. The third, which is here illustrated, is a drop signal, which consists of a magnet and a pendulum armature therefrom, the projecting magnet core being curved to correspond to the swinging of the armature on its pivot when attracted and the armature when thus swung operating to cause the indication.

Fig. 1 is a plan through the switchboard, showing three signals side by side, the armature portion of the outer signals being omitted. Fig. 2 is a longitudinal section through the signal. Fig. 3 is a front view of the signals shown in Fig. 1. Figs. 4 and 5 are vertical sections through the signal, being substantially on the lines 4 4 and 5 5 of Fig. 2. Fig. 6 is a perspective view of the pendent armature and the indication shield.



FIGS. 1-6.—TELEPHONE DROP SIGNAL.

Referring to the parts by letters, *A* represents a frame of the signal, consisting of a plate of iron bent into the four-sided box-like form shown, thus providing the two parallel sides *a a*, the rear end *a'*, and the front a^2, composed of the two extreme ends of the plate. Near their forward ends the sides *a a* are held together by the screw *k*, taking through the distance sleeve *K*.

B represents a plate of the switchboard, and the forward ends a^3 a^3 of the frame *A* are secured to the rear side of this plate by screws *J*, which screw through the plate *B* into those ends.

Within the frame is the operating magnet. This includes the core *C*, the winding *c* therefor, and the insulating heads *c'* and c^2. The head *c'* has in its edges a pair of notches c^3, into which take pins or lugs a^3, projecting inward from the side plates *a* of the frame. At the rear end the magnet is supported by a screw bolt *D*, which screws into its rear end through a bushing *d*, which bushing screws into a threaded opening in the back side *a'* of the frame. The rear end of the core *C* abuts against the end of the bushing. By slightly loosening the screw *D* the bushing may be turned in one direction or the other to move the magnet forward or backward as desired, and then when the screw *D* is tightened the bushing is clamped to the core and the adjustment locked. The ends of the winding *c* are secured to a pair of binding posts c^4, projecting rearward from the head c^2 through notches in the frame end *a'*.

The armature consists of the billet-shaped piece *E*, of soft iron, which is pivoted to the frame by means of the pin *e*, which passes from one side of the frame to the other through ears *e'*, carried by an upwardly-extending plate e^2, which is set into the billet *E*, the armature thus being a pendulum. The forward end of the magnet core is curved downward and forward, as shown at c^5 on a centre which is approximately the axle of the pin *e*. The armature hangs normally just at the point of the projecting core and when the latter is magnetized swings rearward on its support *e*, thus always being very close to the core. A projecting strip of brass or other non-magnetic material e^3 is set into the armature to prevent the latter actually contacting with the core and thereby sticking.

The curve c^5 of the magnet core and the latter's adjustment are such that the strip e^3 just clears the core during the effective swing of the armature and contacts with the core at the end of such swing, thus obviating the necessity of an additional stop. Thus the curve c^5 may be a circular arc about a point just a little in front of the axis of the pin *e*. With the projecting end of the core so curved and the armature provided with a projecting non-magnetic strip e^3 one can adjust the core, so that it may be at all times extremely close to the armature without any danger of the latter sticking. Thus a very sensitive operation is secured.

The indicator which the signal discloses is a numeral on a small plate *F*, which is secured on the front side of the plate *B*, preferably by upper and lower flanges on the plate *F*, projecting rearward onto the upper edge of the plate *B* and into an opening *b* in that plate. This indicator is normally covered by a shield *G*, which is carried by an arm *g*, extending through the opening *b* and over the pin *e* and then bent downward, as at *g'*, on the rear side of the plate e^2, being set into the armature *E* alongside the plate e^2. The shield and its supporting arm are very light, made of aluminum. When the armature hangs by gravity directly beneath its support *e*, the indication is covered by the plate or shield *G*. As soon as the core *C* is energized, however, the armature is drawn rearward, thus swinging down the shield and disclosing the indication.

In order to make as effective as possible the magnetic pull, the armature should be acted upon by both poles of the magnet, the iron frame constituting one pole. If the armature be simply swung between the plane side plates of the frame, it is very difficult to guide the armature lightly and at the same time accurately enough so that one end or the other would not stick to the frame plate without increasing the air-gap between the armature ends and the plates sufficiently to largely weaken the effective pull of those plates. Mr. North reconciles these two opposing factors by making recesses a^4 in the side plates of the frame, into which recesses the armature extends.

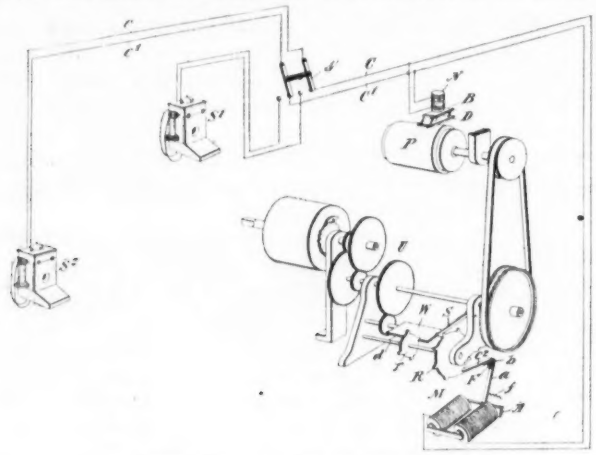
The recesses are of such shape as to remove the walls of the side plate some distance from the armature above it and in front of it, while at the rear side they are approximately concentric with the curve of oscillation, thus always remaining close to the armature. By this means the air-gap is reduced to a minimum, sticking prevented, and the retarding magnetic influence of the plates in front of the armature removed. The armature swings freely, and its whole guiding is dependent upon the ears e', and it has no opportunity or tendency to work into contact with anything. Moreover, the recesses or openings a^4 allow the use of a sufficiently long and heavy armature to conveniently counterbalance the weight and leverage of the arm g and the shield G.

It is most convenient to construct the recesses a^4 by punching an opening clear through the side plate. In order to prevent the magnetization of one signal from influencing the armature of an adjacent signal sympathetically at such opening, Mr. North places on each side of the frame outside of the openings a^4 a protecting plate H, of magnetic material, which thus operates to confine the magnetic lines of each signal to itself, preventing it disturbing the adjacent signal. This also increases the efficiency of each signal, saving lines of force otherwise wasted. These plates H may be conveniently made of tin plate, secured in place by flanges bent over the upper and lower edges of the frame plates a a and ears h on the flanges taking onto the inner side of these plates.

Recording Telephonic Messages.

It has often been proposed to record telephonic messages by phonograph, etc., and Mr. R. Günther, of Vienna, has another try at this apparently difficult subject in a patent issued to him last week in this country. His method is illustrated herewith.

In the cut S' and S^2 indicate the telephone instruments at two subscribers' stations; c c', the main line connecting said stations; s, the switch at Station S', controlling the call and telephone circuits; C and C', a local shunt circuit adapted to be included in the call and telephone circuit through the switch s, said shunt circuit including an electromagnet M, which operates the starting and stopping mechanism for the telephone motor, and an electromagnet N for transmitting telephonic impulses to the diaphragm that carries the recording style of the phonograph.



RECORDING TELEPHONE MESSAGES.

Should it become necessary for the person at station S' to absent himself, he simply manipulates the switch s so as to cut the call and receiver circuits out of the main line and connect the shunt circuit C C' with said main line, so that on calling the electromagnets M and N will be energized, the starting device actuated, the motor U for the phonograph cylinder started, and the phonograph placed in condition to receive and record the message transmitted. When this is done and station S' called off in the usual manner, the electromagnets will be demagnetized and the motor for the graphophone cylinder stopped, as hereinafter explained. On the return of the subscriber he can then switch the shunt circuit out of the main line and switch the call and receiver circuit back into said main line and have the recorded message reproduced in a well-known manner, the electromagnet N being of course first removed.

For starting and stopping the motor for the record cylinder of the graphophone Mr. Günther provides a stop device normally in engagement with an operative element of the motor and a device for controlling the operation of said stop device. As shown in the drawings, the stop device consists of a toothed wheel r, fast on an arbor d and normally engaging the fly W of a spring-actuated motor, and the device for controlling the operation of said toothed wheel r consists of a ratchet wheel R on said arbor d, having twice as many teeth as the wheel r. The ratchet wheel R is operated by a pawl arm c^2, pivoted to the free end b of an armature lever a on an armature A and held in contact with the ratchet wheel R by a spring F, and M is the electromagnet, whose poles are extended toward each other with a view to increasing the magnetic field.

It will readily be understood that when the electromagnet M is energized and the armature A is attracted the pawl arm c will cause the wheels R and r to revolve a distance equal to that between two teeth on wheel R; but inasmuch as the wheel r has only half as many teeth as the wheel R and in view of the fact that the arrangement of the teeth on both wheels is such that those on wheel R lead or are in advance of the teeth on wheel r the fly W will be released and the motor started. When, on the contrary, the electromagnet M is demagnetized, the armature A and its lever a will be retracted by a spring f, the pawl arm c^2 riding back on wheel R to engage the next tooth thereon, so that when the electromagnet is again energized and demagnetized by the closure and subsequent interruption of the main line circuit in calling off as usual said armature lever will first be attracted, thereby imparting another partial revolution to wheels R and r, whereby a tooth of the latter is moved into the path of the fly W' and the motor stopped, the armature lever being next retracted to a position to again impart a partial rotation to wheels R and r, and thereby release the fly W on the next closure of the main line circuit.

Or Mr. Günther would arrange a metallic diaphragm B in front of the pole of the electromagnet N and connect said diaphragm with the diaphragm D that carries the phonograph style, and thus transmit the current impulses to the last-named diaphragm, which will be of advantage in long-distance telephones where direct transmission becomes more or less difficult, and the weakening of the vibrations of the diaphragm resulting from this arrangement may be avoided by the interposition of a sound strengthener.

CURRENT NEWS AND NOTES.

CANADIAN-ENGLISH CABLE.—It is announced that the Dominion Government hopes to have a short direct cable laid between Scotland and Belle Isle, on the Labrador coast of Canada, via the north of Ireland, thus giving Canada a new cable line to Great Britain.

THE TELEPHONE IN CANADA.—At a recent meeting of the Municipal Telephone Committee of the City Council of Toronto, Ont., the chairman presented a report which gave the following statement of the Bell Telephone Company's business in Canada: Net revenue, $353,307; number of telephones, 34,923; average profit per telephone, $10.11; miles of long-distance lines, 18,920; miles of poles, 6229.

HUBBARD GEOGRAPHICAL BUILDING.—The heirs of the late Gardiner G. Hubbard, of Washington, founder of the National Geographic Society and its president down to the time of his death, are to erect a building in Washington for the use of the society. The structure will be a memorial to Mr. Hubbard, and will cost $40,000. Mr. Hubbard will be remembered as the father-in-law of Prof. A. G. Bell and one of the largest owners of the Bell Telephone system.

UNDERWRITERS' NATIONAL ELECTRIC ASSOCIATION.—The annual meeting of the electrical committee of the Underwriters' National Electric Association will be held at the New York Board Rooms, 32 Nassau Street, on Tuesday, Dec. 11, at 10 a. m.

The first thing in order will be action on the report of the special committee on the grounding of low potential circuits, and the changes in the rules which have been suggested as being necessary to allow this. The presence of any one interested in the formulation and progress of the National Code is invited.

ELECTRICAL STEERING DEVICE.—The Pacific Mail steamship City of Peking has been equipped with an electrical steering device, connected with the ship's compass. It was invented by Chief Officer R. P. Buchnam. The instrument makes records, showing the ship's position at all times, and the records are preserved for reference. It is so arranged that the vessel cannot deviate from her course without ringing an alarm. The course can be made from 100 ft. to 300 ft. in width. Mr. Bucknam is now perfecting a contrivance by the use of which the steamer will steer automatically after her course has once been set.

PARIS AUTOMOBILE SHOW.—It has now been definitely decided that the next automobile and cycle show shall be held in January in the Grand Palais des Champs Elysées. The Automobile Manufacturers' Union and the Association of Cycle Manufacturers are in full agreement. The Automobile Club has favored the idea for some time past. M. Rives, manager of the show, and M. Ballif, treasurer, have selected an organizing committee, which includes all the prominent men in the automobile and cycle worlds. Under such auspices and favored with the exceptional advantages of a magnificent building, the next automobile and cycle show cannot but be an unqualified success. Much credit is due to the Automobile Club for the lead it has taken in promoting this arrangement.

CANADIAN WATER POWER DEVELOPMENT.—The Shieks Island dam, at the foot of the Longue Sault Rapids, ten miles went of Cornwall, Ont., is to be utilized for the purpose of generating electricity to light the Cornwall Canal and drive a good deal of machinery in the town of Cornwall. Mr. M. P. Davis, of Ottawa, will construct the necessary works. The plans for the power development have been prepared by T. Pringle & Son, of Montreal, who had charge of the installation at the Lachine Rapids and at the Shawinigan Falls, Que. The work in hand at Cornwall includes the cutting of a canal about 200 ft. long, 5 ft. wide at the bottom and 21 feet deep; the erection of a power house and the installation of turbines, generators, exciters, and other necessary machinery. There will be three twin turbines of 1000 horse-power each, directly connected to the generators. The power house will provide for the development of 4000 horse-power, only part of which, however, will be furnished at first. Besides lighting the canal, Mr. Davis will transmit 1000 horse-power to Cornwall, Ont. The amount of power available at Shieks Island is said to be almost unlimited. The cost of developing the power will be about $150,000. The contract calls for the lights being turned on not later than April 15, 1901.

SNAP SWITCHES are the theme of two patents recently issued to Monroe Guett, of Hartford, Conn. In one of them, the invention resides in a switch having a single actuating spring that is made tense by the rotation of the handle in either direction and a cam that holds a stud in the path of the spring plate until the spring by the rotation of the handle has been given the proper tension and the stud next in advance has been projected into the path of the spring plate. The cam then withdraws the stud that is holding the spring plate and permits the spring to throw that plate until it is stopped by the stud which was moved out by the cam as the handle was turned. The cam is then caused by the spring to assume such a position that studs on both sides of the spring plate project into its path and there remain until the handle spindle is again turned. The other patent relates to a cover for a rotary snap switch consisting of an exterior metallic shell having a circular top portion with a central perforation and an annular side portion, and an interior shell formed of sheet insulating material with a circular top portion having a central perforation and an annular side portion formed of integral tongues projecting from the central portion, the side edges of each tongue being parallel and the end edge of each tongue being at right angles with the side edges.

PARIS EXPOSITION MUDDLE.—A cable dispatch of Oct. 27 from Paris says: The Exposition exhibitors are in an unpleasant position in not knowing whether the Exposition will close on the date originally set, Monday, Nov. 5, or whether the announcement, made on Wednesday, that it would be prolonged till Nov. 11, is correct. At the headquarters of the American Commissioners no light could be thrown on the situation. The only statement forthcoming was that they had been consulted on the subject of the prolongation and Commissioner-General Peck had entered a protest. Since then nothing official has been received from the French authorities. The French papers, however, last Wednesday made the statement about the prolongation, apparently authoritatively, some saying the announcement was official. But it has not appeared yet in the Journal Officiel. In the meantime the exhibitors are in a quandary, not knowing how to proceed with contracts and other details of getting exhibits from the grounds. Many say they intend to commence dismantling on Nov. 6, which is a day after the original date set for closing. They will be unable to remove their goods from the grounds, however, for the authorities have given instructions not to allow the taking of boxes or materials from inside the grounds. The situation is causing some ill-feeling, and it is certain that confusion and disarranged exhibits will be presented to view should the prolongation occur.

HIGH VACUUM FOR LAMPS.—A patent has been granted to Mr. John W. Howell, the well-known expert in incandescent lamps, for a process of producing high vacuum. After the preliminary exhaustion he admits to the bulb a determinate volume of phosphin or phosphoretted hydrogen gas at ordinary atmospheric temperatures, which acts not only mechanically as a vehicle for assisting the exhaustion of the residual gases by a washing-out action, but establishes a chemical reaction with such hydrocarbon vapors or air as may be present, and thus effects their extraction from the bulb upon further action of the pump and exhaustion of the phosphoretted hydrogen. The result on a lamp treated according to this process is a very high vacuum and an increased output of 50 per cent in the product of an operator's work during a given period and a resultant cheapening of the cost of the lamp. This decrease in the expense is an incident principally of the gaseous treatment by which a gang or group of lamps may be simultaneously subjected to the action of the gas, and an attendant may therefore manage several independent machines or exhausting devices. No particular organization of apparatus is required to carry out the invention, except provisions for pumping off the air or gases and for introducing the phosphin. It will, however, greatly facilitate an increased output per operator to follow the usual plan of connecting with each pump an exhaustion tube having a plurality of air-tight sockets or openings to receive the stems of a group of lamps. The arrangement of such apparatus and the construction of the lamp are familiar to those skilled in lamp manufacture.

LETTER TO THE EDITORS.

The Question of Light Distribution.

To the Editors of Electrical World and Engineer:

Sirs:—The interesting discussion on the rating of incandescent lamps now going on in your columns is of special value, as it brings up the question of light distribution, which is so often unduly neglected.

Theoretically, in purchasing lamps, the "economic man" should consider not only cheapness, life and efficiency, but also the distribution of light. In practice, the relative importance of these four attributes depends on the kind of lighting, and on general circumstances. For example, the qualities which are essential for illuminating the dining room of a big hotel might not be very important in lighting up a railroad tunnel. The distribution afforded by incandescent lamps is so good compared with that afforded by some other sources of light, that the tendency is to leave it out of consideration. There are no shadows, and in the worst case of bad distribution, it is not easy to detect any marked diminution of light when looking at the bulb end on. Even where the photometer shows a difference of 100 per cent between the "end on" candle-power readings of two lamps, the eye, or, at any rate, my eye, cannot detect any such difference in the apparent brilliancy of the lamp in the given direction, when in actual operation.

Even although the question of distribution may not always be of first importance, it is not unreasonable to suggest that the method of rating candle-power should take it into account. The present method, as has been pointed out elsewhere in your columns, is open to the serious objection that it puts a premium on the light in a particular direction, and not the most advantageous direction at that. The light

from the end of the bulb is very desirable in a lamp. The majority of incandescent lights are placed so that they point downwards. This is the case to such an extent that the use of shades and porcelain reflectors has become widespread.

The expression "the useful light," applied to the rays from the end of the bulb, has become quite familiar to the public. It seems to me that what should be meant by it is that the light from the end of the bulb per unit solid angle is usually more valuable than that from the sides. It may be gravely questioned, however, if this fact is a sufficient ground for advocating a system of rating on the basis of "useful light." Such a system would put a premium on light from a particular direction as much as the present system does. If, indeed, we must have a unidirectional system of rating, perhaps the end-on method would be advantageous, because, as Mr. Elliott suggested in your recent issue, it practically involves the necessity of good horizontal distribution.

Mean spherical or mean lower hemispherical candle-power measurements, with a specified number of readings at specified angles, might be adopted with plausibility. It is a question, however, whether such a plan as either of these would not be more trouble than it is worth.

FITZHUGH TOWNSEND.

NEW YORK CITY.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

By CARL HERING.

DYNAMOS, MOTORS AND TRANSFORMERS.

Constant Potential Direct Current Converter.—DAVIES.—An illustrated description of a converter in which a constant potential is obtained at all loads in the following way: There is a particular arrangement of the armature winding used in connection with a special compensating winding on the field magnet. A two-pole machine is considered, the field magnet being shown in Fig. 1; each pole is provided with a slot in which the compensating coil is wound; it is in series with the secondary circuit and connected up so as to assist the main magnet winding; the object is to concentrate the lines of force of the field magnet within the area enclosed by the compensating coils. The armature is shown in Fig. 2, only two coils being shown; the primary coil is wound with any usual pitch; the secondary coil is chord wound, with such a pitch that it just encloses the lines of force which pass through the compensating coil, but does not enclose any more than this; the angular pitch of the coil must therefore be approximately the same as the angle indicated in Fig. 1. The action of the device is explained as follows: At light load, when there is no current in the compensating coils, those lines of force which are

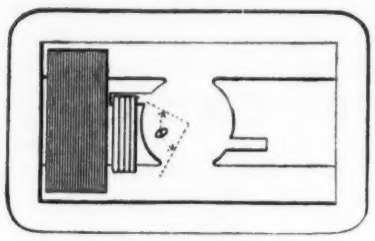


FIG. 1.

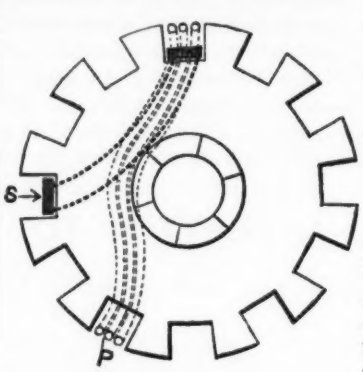


FIG. 2.

embraced by the compensating coils, are usefully cut by both the primary and secondary winding, but the remainder are useless so far as the production of e. m. f. in the secondary winding is concerned, owing to the small pitch of the coils in the secondary winding. This makes the ratio of the secondary to the primary volts less than it otherwise would be. When the load increases, the compensating coils begin to act; "they divert some of the lines from the small polar horn and drive them through the polar area enclosed by the compensating coils, the total flux remaining practically constant." The result is that a larger proportion of the lines is usefully cut by the secondary winding. The ratio of the secondary to the primary volts is therefore greater at full than at light load. He does not say that he has used this device in practice.—Lond. *Elec. Rev.*, Oct. 19.

Lanhoffer Dynamo for Widely Varying Voltages.—BRUNSWICK and ALIAMET.—An illustrated description of a direct current dynamo, designed by Lanhoffer, for widely varying voltages. The maximum voltage is fixed by the saturation of the field magnet, but it is claimed that the minimum voltage can be made five times smaller than the maximum without resulting in any inconvenience with respect to commutation. There are two separate fields, acting upon one armature; the e. m. fs. induced in it by the two fields may add together or oppose to one another, according to different conditions of the field excitation. The same principle may be applied to the design of a direct current converter, of which the ratio of transformation can be varied through wide limits. If the dynamo is used as a motor and supplied with direct current, it will run at widely different speeds.—*L'Elec.*, Sept. 29; translated and commented upon in some editorial notes in Lond. *Elec. Eng.*, Oct. 12.

REFERENCES.

Diagrams of the General Transformer.—EMDE.—A communication in which he discusses some special points in the letter of Henbach (Digest, Oct. 20); he is in full agreement with him.—*Elek. Zeit.*, Oct. 11.

Induction Motor.—BROCKSMITH.—An illustrated article giving a design of a ½-hp single-phase induction motor; also diagrams showing the different methods of starting single-phase induction motors.—*Am. Elec.*, Oct.

LIGHTS AND LIGHTING.

Street Lighting at Grand Rapids.—DAMON.—A long, illustrated article on the street lighting plant of Grand Rapids, Mich. There are 500 arc lamps of the enclosed type, using 6.6 ampere direct current at 70 volts per lamp. The plant now has a dynamo capacity sufficient to furnish current to 900 arc lamps, which is divided into six electrical units. The Board of Public Works, in its annual report, gives the cost per lamp per year as $48.55, based upon the expense of operating during the first six months.—*Amer. Elec.*, Oct.

POWER.

Electricity in the Printing Office.—TAPLEY.—An illustrated article which begins with a brief reference to the use of electricity in a printing office for lighting and electroplating. He says that dynamos for electroplating have not been given the care in designing that all other classes of dynamo electric machinery have received, and, as a rule, are built on the patterns used 15 or 20 years ago. He discusses at some length the use of the electric motor for driving printing machinery and discusses its main advantages; decrease in power consumption, location of machinery irrespective of main line shaft, increased prdouct, efficiency control, and lower cost of maintenance and operation of the plant as a whole. The question as to whether the geared or the direct connected motor should be adopted for printing press work is still a disputed one, both types having distinct advantages, but neither having all; compactness and noiselessness are the principal advantages of the direct connected types; their speed necessarily cannot be standard, their cost is generally twice that of a standard, moderate speed, geared motor; the disadvantage of the geared motor is principally that the ratio of gearing made necessary by the speeds of certain makes of presses is such that it is practically impossible to run without noise, its first cost is lower and repairs can be quickly made. The prospects of electricity superseding both steam and gas for heating in the various branches of bindery work are very promising; the heads for embossing and stamping presses, and heaters for finishing tools and glue kettles have received a sufficient commercial test to prove their worth.—*Cassier's Mag.*, Nov.

Electric Cranes.—An illustrated article on electric cranes made by the British Thomson-Houston Company. It prefers three motor cranes, one series wound for each motion; shunt and compound wound motors maintaining practically a constant speed at all loads, are used only for single motor equipments. Magnetic blow-out controllers are used, and for the smaller sizes they have only one

handle both for controlling the speed and reversing the motion. A practical modification sometimes used, consists of two of these controllers connected by means of a simple form of universal gearing which is operated by one lever; this is so contrived that any two motions of the crane can be controlled by means of this one lever, the arrangement being such that the movement of the lever indicates the direction in which the load is traveling; thus one of these apparatus can be used for the hoisting and traversing motor; when the lever is raised the load will be hoisted, and when it is moved over to the right or left the load will move to the right or left, respectively, whereas, if the lever be moved upward in a diagonal direction the load will be both hoisted and traversed in the direction indicated by the lever. An electromagnetic brake is operated by the hoisting motor and is so arranged that when the load is at rest and the controller is in the "off" position, the brake is automatically applied, but as soon as the current is supplied to the motor the series electromagnet controlling the brake releases the latter.—Lond. *Elec.*, Oct. 19.

Electric Brake for Alternating Currents.—A. KOLBEN.—A communication referring to the paper of Fischer-Hinnen (Digest, Oct. 13). He says that solenoid brakes can be easily calculated after the conditions of straying have been determined by experiments. He gives an illustration of a solenoid brake, used successfully for three-phase cranes, and gives some data to show that the solenoid brake is cheaper and works more economically than a brake of the Fischer-Hinnen type.—*Elek. Zeit.*, Oct. 11.

REFERENCE.

Electric Exhaust Fan.—An illustrated description of a centrifugal fan or exhaust blower driven by a direct connected motor. The largest type requires 50 horse-power when developing 6-oz. pressure at 1100 r. p. m.—*Eng. and Min. Jour.*, Oct. 27.

TRACTION.

Tramways Association Meeting.—An account of the proceedings of the recent annual meeting of the Association of German tramways and light railway companies and of the papers read. Vellguth, on accidents, stated that on 53 roads, representing 156,769,813 car-kilometers, and carrying 530,000,000 persons, as well as 1,150,000 freight car-miles, 172 accidents occurred. This does not include the casualties on the Berlin street railway, on whose lines 2,687 persons were injured, 16 fatally and 101 seriously. Fromm and Poetz discussed the different kinds of brakes for electric cars, and said that 63 German roads use mostly the short-circuit electric brakes, some use air brakes and a few both. Some statistical information is given on the weights of the cars. The speeds permitted vary generally from 7½ to 15½ miles per hour. The distance in which the car can be stopped when running from 9 to 12 miles per hour is from 26 to 40 ft. when empty, and 33 to 50 ft. when loaded. Fromm said that it was seldom necessary to stop a car within its own length when going at a high speed, and as the use of short circuit brakes is generally ruinous to gear wheels and armatures, electric and magnetic brakes ought to be used only in emergencies. Vellguth gave a formula by which the cost of two-axle and four-axle cars may be compared, this formula being derived from the experience of the Hamburg tramways. Rollman considered the transportation facilities at the Paris Exposition quite inadequate. The members decided to make a trip to the United States at the end of May, 1901. Regarding the advisability of publishing street railway statistics as proposed by the Minister of Railways was discussed, and it was decided to compile this work if the government pays the expense.—*St. R'y Jour.*, Oct. 13, and Int. Ed., Oct.

Electric Locomotive in Japan.—A short illustrated description of a plant for carrying off the excavated rocks in the boring of a tunnel through the Sasago Toge Mountain on the line of the proposed central steam railway in Japan. The Government is building the roadbed; the tunnel will be nearly three miles long. The power plant consists of a 46.5-hp Leffel horizontal turbine with an 80-ft. head, and provided with Replogle's mechanical governor; the dynamo is a 45-kw 500-volt Westinghouse machine, running at 850 revolutions; the locomotive is a Westinghouse double-motor truck provided with two 15-hp motors; the draw-bar pull is 1500 lbs. and the gauge of the road only 30 ins.; it carries 6549 lbs. in one train and is doing excellent service. There is also a 16-hp turbine driving a 15-kw dynamo for lighting the tunnel.—*Elec. Friend*, Japan, June 15.

Storage Battery in Railway Power Stations.—NORRIS.—A paper read at the New York State St. R'y Convention. He considers 6 per cent per annum a conservative figure for the depreciation of the batteries in small railway plants, and the first cost about $100 per kilowatt output when discharged in one hour. Boosters, on the other hand, would cost between $100 and $150 per kilowatt. He gives 23 per cent as an average reduction in the coal consumption when storage batteries are used; there is also considerable saving in the first cost of the copper feeders. Some records of tests made by him at the Buffalo plant are given.—*St. R'y Jour.*, Sept. 29, and Int. Ed., Oct.

Storage Batteries as Railway Boosters.—DAVIS.—A reprint of a paper read before the New England St. R'y Club. The author, who is connected with one of the manufacturers of storage batteries, discusses the three methods of feeding, first with a battery, the second with additional copper only, and the third with a booster and a separate feeder. He gives the cost of each and concludes that the battery system is much the cheaper; the paper illustrated with a number of diagrams. One figure shows the increase in station economy secured by operating the engines under constant load near their full capacity. —*St. R'y Jour.*, Sept. 15, and Int. Ed., Oct.

Water Power Railway Plant.—ZURFLUH.—An illustrated description of the power house of the Toledo & Maumee Valley Traction Company, Ohio. The generating equipment consists of a 600-hp turbine and a 500-hp auxiliary steam plant for use in case of failure in the water supply or of any temporary extraordinary demand for power. Formerly the road was supplied with power from the steam-driven station of another company at a cost of 2¼ cents per kilowatt-hour, while 1¼ cents was supposed to be the actual cost of generation; with the water power plant the cost per kilowatt-hour is reported as being 0.048 cent; he does not state what items are and are not included in this figure.—*Am. Elec.*, Oct.

REFERENCES.

Storage Batteries in Tramway Stations.—REYNOLDS.—An article on the use of a storage battery in a tramway station for steadying the load, with load curves from the plants of Peekskill, N. Y., and Easton, Pa., where such batteries are installed; also a load curve from a synchronous converter sub-station with storage battery at Dover, N. H.; also a load curve from a station without a battery.—*Am. Elec.*, Oct.

Italy.—A short article on the application of electric traction to the lines of the Italian Southern R'y Company. Some details are given in the Lecco-Sondrio-Chiavenna line with three-phase induction motors worked at 3000 volts on the locomotives, while the transmission is at 20,000 volts; also on the Bologna-St. Felice line with storage batteries on the cars. Both lines were described before in the Digest. —Lond. *Elec. Rev.*, Oct. 19.

Italy.—BIGNAMI.—A long, illustrated article, giving a summary of the development of electric railways in Italy.—*Eng. Mag.*, Nov.

Rochester and Sodus Bay Railway.—NICHOLL.—A paper read at the New York State Street R'y Ass'n. A description of this 40-mile line, the power for which is transmitted at 10,000 volts alternating and transformed by synchronous converters.—*St. R'y Jour.*, Sept. 29, and Int. Ed., Oct.

Carlisle, England.—A description of this 8-mile road, which purchases current from the municipality at 4 to 3 cents per kilowatt-hour and uses the side running trolley.—*St. R'y Jour.*, Oct. 13, and Int. Ed., Oct.

Automobile Motor.—LINCOLN.—An illustrated description of an automobile motor, made by the Lincoln Elec. Company. It is compound wound and the controller is arranged so that the shunt field is constant, whatever the voltage on the armature may be. This arrangement enables a high efficiency to be obtained at small loads.—*Am. Elec.*, Oct.

Slipping of Car Wheels.—PARHAM.—An article on the question why, under certain conditions, one pair of wheels on a car may persist in slipping to such an extent that the car cannot be stopped; on grades it is the front pair of wheels which generally slip, while on curves it is the back pair. The reason of this fact is explained by the action of two series wound motors connected in series.—*Am. Elec.*, Oct.

New York State Street Railway Association.—A full verbatim report of the proceedings of the recent annual convention in Buffalo.—*St. R'y Jour.*, Oct. 13, and Int. Ed., Oct.

INSTALLATIONS. SYSTEMS AND APPLIANCES.

Coupling Accumulators at Central Stations.—GIRAULT.—With the aid of formulas and numerical data, he shows the disadvantages of endeavoring to charge the accumulators with a machine at constant speed and variable excitation, as the maximum voltage of a machine

must be 50 per cent above the normal; in charging the batteries by dividing them into two groups and connecting them in parallel, the difficulty arises with the charging of the end regulating cells, because they are usually placed only at one end of the battery; during parts of the charge they must then be replaced by resistances and the loss of energy in these is quite appreciable, as he shows. To avoid this loss of energy he describes a system in which half of the end regulating cells are at one end of the battery and half at the other, so that when the two halves of the battery are charged in parallel, the end cells may be cut out, one by one, in both groups. He describes how they may be cut out, one by one, during discharge, without a variation in the voltage of more than two volts.—*L'Ind. Elec.*, Sept. 25.

Electrical Works in Pekin and Seoul.—Short descriptions of the electric works in those two Oriental metropoli. At Pekin a German company called the Chinese Electric Company is installing a 60-hp engine and a three-phase 270-volt 140-ampere Siemens & Halske generator. The Pekin electric railway is under government control and has a length of 3 kilometers, from Machapoo to Anchineven. The plant consists of two Lancashire boilers, two compound engines and a 250-kw 500-volt generator, all of Siemens & Halske make. The Seoul electric railway in Korea is an American plant and contains a 25-hp Babcock & Wilcox boiler, a 115-hp McIntosh & Seymour compound engine and a 75-kw 500-volt Westinghouse generator; the cars have the Brill single motor truck.—*Elec. Friend*, Japan, June 15.

Liverpool.—An illustrated description of the two new municipal direct current power stations in Liverpool for traction and lighting. The distribution of electrical energy for the tramways is at 500 volts pressure with rail return, and the distribution for lighting and power is on the three-wire system of 460 volts between the outers, the middle wire being earthed at the station. The number of units supplied during the first half year of 1900 was 2,197,937 for tramways, 2,243,225 for lighting and power, the total being 4,441,162 kilowatt hours. —Lond. *Elec., Elec. Rev., Elec. Eng.*, Oct. 19.

Rochdale.—An illustrated description of the new municipal electric lighting plant of Rochdale, Lancashire. The three-wire system with balancing machine and storage battery is used, the supply to consumers being at a pressure of 220 volts, or 2 x 220 volts. There are two steam-driven 180-kw dynamos and a battery giving 60 amperes for 10 kilowatts or 250 amperes for one hour.—Lond. *Elec.*, Oct. 19.

Buenos Ayres.—HULKE.—A long, very well illustrated description of the electric plant of the General Company of Electricity of the City of Buenos Ayres, which is one of the four companies which supply that city with current. The plant has been erected by the Union Electric Company, of Berlin (which is affiliated with the General Electric Company of this country). The current is used especially for lighting, but also for power and traction. The monocyclic system is used. There are four steam-driven monocyclic generators, each giving 500 kilowatts at 125 r. p. m., the frequency being 50, the voltage 3150 to 3450.—*Elek. Zeit.*, Oct. 11.

Wright System of Charging.—E. H.—A short article giving tabulated data showing the results of the use of the well-known Wright maximum demand system at Brighton. He claims that the application of this system has produced quite remarkable results. One table shows the rapid increase in the number of customers and the reduction of the mean price of the energy in a period of three years. Another table shows the relative values of different kinds of customers to the central station, based on the receipts. Another shows the progressive reduction in prices, the consumption, the receipts and the profits for a period of eight years; the consumption increased 20 times, while the number of customers increased only 10 times; the utilization of the material at the station doubled in the seven years. —*L'Ind. Elec.*, Sept. 25.

REFERENCES.

Switch Gears.—WARRILOW.—The conclusion of his long illustrated serial on "The evolution of switch gears for high pressure alternating currents in Great Britain" (Digest, Oct. 27). He concludes the description of the Ferranti switch gear and adds some general remarks on the modification of switchboards which has become necessary by the increased size of generating units.—Lond. *Elec. Eng.*, Oct. 12.

High Tension Switch.—A brief illustrated description of a high tension switch designed by Wilson. The features are the long and quick double break and an insulating shutter which is worked by a lever connected to the switch handle gear and knocks out any arc which under unusual circumstances might be formed in spite of the good break.—Lond. *Elec. Eng.*, Oct. 12.

Hotel Installation.—An illustrated description of the electric installation at the Raleigh Hotel in Washington.—Lond. *Elec. Eng.*, Oct. 12.

Small Towns.—BROWN.—An article on electricity supply for small towns, especially on the conditions of municipal plants in Great Britain.—Lond. *Elec.*, Oct. 19.

WIRES, WIRING AND CONDUITS.

Cables.—A reprint of the article of Maver (noticed in the Digest Oct. 13), and some brief editorial notes on it. It is said that if in the United States conductors are not usually stranded unless of a greater diameter than a quarter of an inch, American users of cable must be satisfied with considerably less flexibility than is considered necessary in Great Britain. "It would seem that the Americans have not yet imitated some manufacturers here in substituting layers of tape ('half lap') in the same direction for the 'reverse lap' universally in vogue at one time." Seamless rubber insulation has been found wanting by British manufacturers, as "the modified sausage-machine employed for covering wire in this manner demands an inferior and more plastic India rubber compound."—Lond. *Elec.*, Oct. 19.

REFERENCES.

Underground Subways.—An editorial referring to the state of disorder in the streets of London, due to the laying of cables. It is pointed out that it would have been better to build a subway in which all cables and pipes would have been placed and could be repaired, renewed and extended without disturbing the surface of the roadway.—Lond. *Elec.*, Oct. 19.

Interior Wiring.—KNOX.—An illustrated article giving a description in detail of the wiring of an office building in New York.—*Am. Elec., Oct.*

ELECTRO-PHYSICS AND MAGNETISM.

Skin Effects.—HERZOG and FELDMANN.—A paper illustrated by diagrams in which they give several approximate and practical formulas for calculating the ratio of the resistance of a conductor for alternating current and to its resistance for direct current. In some cases it may be of advantage to introduce the term "equivalent layer" for representing the conduction of alternating current through a cylindrical conductor; the current decreases gradually from the outside to the centre, but for quick and approximate calculations the current may be replaced by a current flowing through a concentric layer at the outside of the conductor, the current density being entirely uniform, the thickness of this "equivalent layer" can then be found by a simple formula. They give in a table the results of some measurements with tubes and bands of iron and steel at a frequency of 50; the thickness of the equivalent layer is about 0.5 mm in these cases. The skin effect is of practical importance for three-phase railroads, where the rails are used as return conductors, as the resistance of the rails is then considerably higher than for direct current. The results of some tests are given in tables. The joints increase the resistance of the rails considerably for direct current, while their influence is smaller for alternating current. They recommend to use a low frequency for three-phase railways, about 15 to 20.—*Elek. Zeit.*, Oct. 11.

Spark Discharges from Static Machines.—DAILEY.—A brief illustrated description of a method of increasing the rapidity of the spark discharges at the expense of the density of the sparks, thus producing a kind of high frequency discharge better suited for Giessler tubes, physiological effects, etc. Instead of connecting the two outer coatings of the two Leyden jars usually used with such machines, by a short circuit, the two outers are each connected to the inner coatings of two smaller secondary condensers, the outer coatings of which are connected together. The effect of these additional jars is to prevent the complete discharge of the primary condensers thus increasing the rapidity of the discharges to more than twice the amount.—*Sc. Amer.*, Oct. 13.

Retardation of Discharge.—SWYNGEDAUW.—An account of an experimental investigation of the phenomenon that a spark-gap is not always broken through by an appropriate difference of potential, but that sometimes several seconds may elapse before the discharge passes. He found that there is no retardation if the knobs of the spark-gap are kept brightly polished. Ultra-violet light lowers the discharge potential only when it plays upon the knobs during the time they are being charged, but has no effect after the charging process is completed.—*Jour. de Physique*, Sept.; abstracted in Lond. *Elec.*, Oct. 19.

Relay for Experiments with Electric Waves.—CZUDNOCHOWSKI.—An illustrated description of a simple and cheap relay for experi-

ments with Hertzian waves or with wireless telegraphy. Its general construction resembles that of an electric trembling bell. The axes of the electromagnets are horizontal and the "trembler" hangs vertically by their side. Its lower end is provided with a platinum contact attached to a German-silver arm. The armature is rather heavy and weighted with an adjustable brass ball; it is covered with tissue paper next to the magnet, and to avoid adhesion as far as possible the contact piece is so adjusted that it touches the insulated electrode before the armature touches the magnets. The armature is suspended by means of a thin German silver spring and its normal distance from the magnets is only 1 mm.—*Phys. Zeit.*, Oct. 6; abstracted in Lond. *Elec.*, Oct. 19.

Coherers.—LODGE.—A brief communication in which he remarks that there seems to be a tendency to regard the metallic cohesion which occurs under the influence of an imperceptible spark, as a theory, whereas it is a fact; the metals can be felt to have stuck together. "There may be, and apparently are, anti-coherers which act in an opposite direction, but certainly there are coherers."—Lond. *Elec.*, Oct. 12.

Coherers.—BOSE.—A communication in which he asks whether the cases of cohesion mentioned by Lodge (see abstract above) may not be one aspect of a many-sided phenomenon. The diminution or increase of resistance under electric radiation appears to be a phenomnon of molecular strain. A molecular strained substance should undergo a physico-chemical modification of its properties; cohesion is a special case of this general phenomenon.—Lond. *Elec.*, Oct. 19.

Mechanical Equivalent of Heat.—BARNES.—An abstract of a Royal Society paper, in which he gives an account of a long series of experiments made with the "continuous flow method of calorimetry," which is described. In terms of the thermal unit at 16 degs. C. the mechanical equivalent was found to be 4.18876 joules, which is about 0.132 per cent higher than that obtained by Reynolds and Moorby in their direct mechanical method. He attributes this discrepancy to an incorrectness in the value assumed by him of the e. m. f. of the Clark cell; it should be 1.43325 volts, and not 1.43420 volts, as he has assumed.—Lond. *Elec.*, Oct. 19.

REFERENCE.

Terrestrial Magnetism in France.—MATHIAS.—An account of a detailed survey of the distribution of the magnetic elements in the South of France, which he has made with special reference to the horizontal intensity.—*Comptes Rendus*, Oct. 1; abstracted in Lond. *Elec.*, Oct. 19.

ELECTRO-CHEMISTRY AND BATTERIES.

Substitute for Celluloid in Batteries.—A note stating that Messrs. Cross and Bevan, mentioned in the *Journal of Photography* (London), that they have discovered a new product which they call acetocellulose. It is claimed that acids and alkalies, with the exception of nitric acid, have no action on this even at the temperature of boiling. It is thought that this might have an effect on the manufacture of light accumulators.—*L'Ind. Elec.*, Sept. 25.

REFERENCES.

International Congress for Applied Chemistry.—The first part of an ccount of the proceedings of this Congress, noticed in the Digest Oct. 20.—Lond. *Elec. Rev.*, Oct. 19. A summary of the papers, read at this congress, on calcium carbide, is given in *Sc. Amer.*, Oct. 20.

Electrolytic Production of Soda and Chlorine.—HOBART.—A continuation of his illustrated serial (Digest, Sept. 22), in which he describes several forms of the triple fluid electrolytic cell with diaphragm.—*Am. Elec.*, Oct.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Platinum Silicium Resistances.—RODT.—An article on a new type of resistances made by Heraeus. They are made of thin layers of platinum silicium which are burned upon rods of clay of 7.2 to 12.1 cm. length and 0.5 cm. thickness. He describes some tests made by him, which prove that these resistances are almost free from liability to changes by chemical actions. The resistance was formerly below 150 ohms, but now resistances up to 7000 ohms are made; this is done by cutting a helix into the conducting layer, so that the current must pass through the conductor in a spiral form; or thin threads of platinum silicium are wound around a rod of earthenware. There is some difficulty in getting a good contact between these resistances and the line wire.—*Elek. Zeit.*, Oct. 11.

REFERENCES.

Platinum Thermometers.—CHREE.—An account of a series of tests of six platinum thermometers by means of a Callendar-Griffiths resistance bridge. He discusses thirteen sources of error which may affect the measurements, especially the effects of insufficent immersion.—*Proc. Roy. Soc.*, No. 435, Oct. 3; abstracted in Lond. *Elec.*, Oct. 19.

Incandescent Lamp Photometry.—An illustrated description of a photometer for "same circuit and separate circuit work."—*Am. Elec.*, Oct.

Standard Resistances.—GLAZEBROOK.—His Brit. Phys. Soc. paper in full, giving notes on the measurement of some standard resistances, an abstract of which was noticed in the Digest June 23.—*Phil. Mag.*, October.

TELEGRAPHY TELEPHONY AND SIGNALS.

Pollak-Virag Telegraph System.—A long illustrated abstract of a paper read by Pinter before the Internat. Elec. Congress on new improvements in the Pollak-Virag telegraph system, which was described in the E. W. and E. July 15, 1899. The new improvement is that the receiver records the telegrams, transmitted at a speed of 50,000 to 60,000 words per hour, in ordinary handwriting letters. The receiver formerly consisted of a telephone whose diaphragm was moved by impulses received from the line. To the diaphragm a rod was attached which moved one of three points on which a small concave mirror rested; a beam of light reflected from the mirror registered the movements of the telephone diaphragm on sensitized paper which was moved forward uniformly on a drum; the small mirror was held in position on two pointed prongs of one pole of a stationary permanent magnet and one movable prong constituting the other pole of the magnet by having cemented on its back a small piece of soft iron; to the latter movable prong the rod from the telephone diaphragm was attached. Fig. 1 shows the arrangement of the whole apparatus. *T* is the telephone with the permament magnet and the mirror just described. A record running in lines from left to right, is obtained as follows: The source of light is a stationary glowing filament, which is surrounded by the cylindrical metal mantle *L*; in this mantle a helical slit is cut; when the mantle revolves the ray from the lamp through the slit travels from right to left, hence the ray reflected from the mirror moves from left to right. When the telephone diaphragm vibrates, a record is made in a zig-zag line on the sensitized paper. To produce ordinary handwriting, which requires backward movements also, for certain characters in the alphabet, the receiver *T* has now been modified by using a double apparatus. There are two telephones, as shown in Fig. 2, and the mirror is supported by one fixed point and by two movable points. T_1 causes the perpendicular motions of the rays of light, T_2 the horizontal; as the traces of each letter of ordinary handwriting can be resolved into perpendicular and horizontal components, the ordinary letters can be reproduced. A double line wire is used; one telephone is in the loop of this wire; the other is between the loop and the earth. The self-induction and the capacity of the wires and the effects of the natural oscillation periods of the telephone diaphragms are compensated by means of induction coils and condensers. At the sending end each character must be analyzed into its horizontal and vertical components; the perforating of the paper sending-strip is accomplished by a simple

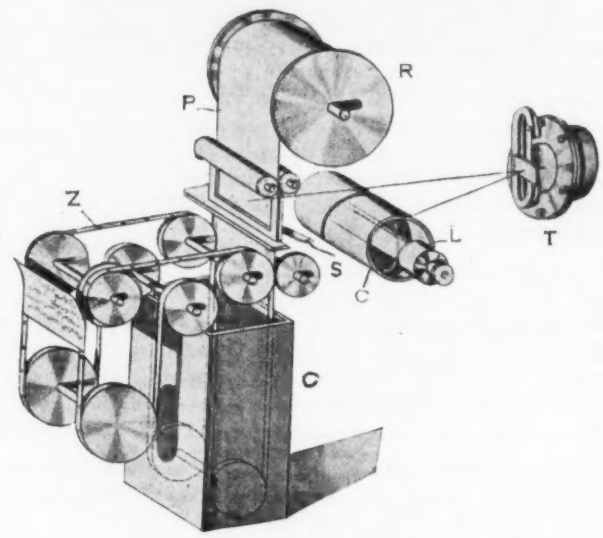


FIG. I.—ARRANGEMENT OF POLLAK-VIRAG APPARATUS.

machine which punches simultaneously all the holes corresponding to any required character. There is no need for the syntonizing of the sending and receiving apparatus, as variations in the speed at either end merely broaden or condense the letters.—*Elek. Zeit.*, Oct. 11; Lond. *Elec.*, Oct. 19; a long illustrated article by Garland begins in Lond. *Elec. Rev.*, Oct. 19.

Telephone Switchboards.—Clausen.—A continuation of his illustrated serial (Oct. 20). He explains why he considers that the multiple switchboard is not a desirable equipment for exchanges giving service to less than 500 subscribers. He also shows that a full central energy exchange system does not possess great advantages over an exchange system in which the signalling only is of the centralized battery type; the consumption of current and necessary expense in operation is less for the latter type, which also gives better service for toll lines. He then discusses at some length the fundamental means which may be used for connecting together subscribers' lines terminating at a common station. This discussion is fully illustrated with diagrams.—*Tel. Mag.*, Oct.

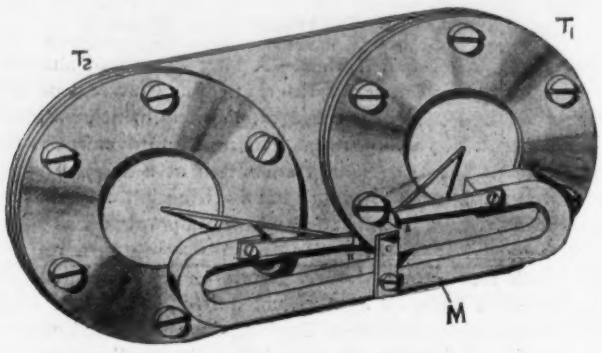


FIG. 2.—THE TWO TELEPHONES.

REFERENCES.

Telegraphone.—Ruhmer.—An illustrated description of a telegraphone for demonstration purposes. An endless steel band is used, wound on four rollers, arranged in a rectangle. The cores of both the recording and reproducing magnets are parallel to the band and touch it.—*Phys. Zeit.*, Oct. 6; abstracted in Lond. *Elec.*, Oct. 19.

Interior Telephone Systems.—Henry.—A continuation of his illustrated serial (Digest, Sept. 22); he continues to discuss inter-communicating systems.—*Am. Elec.*, Oct.

Mors-Mandroux System of Telephony.—Montillot.—An illustrated description of this system, shown at the Exposition, for a number of telephone and telegraph stations, connected together by a double line. It enables one to call up any station from any other, the call being received only by the station called up, but all others being advised that the line is occupied. The system is described and illustrated by diagrams.—*L'Elec.*, Sept. 8.

MISCELLANEOUS.

Cutting Iron by the Electric Arc.—Cravath.—A short article in which it is said that the electric arc affords the cheapest and most convenient method of cutting structural iron work or vault steel. To do successful burning on structural steel a current of not less than 350 amperes should be used; smaller currents will do the work more slowly. The carbon with which the arc is drawn is best about 1½ ins. in diameter and is connected to the negative side of the circuit. A heavy aluminum band bolted around the carbon has been found to be the best method of attaching the conductor cable; to this band a wooden handle is attached.—*Am. Elec.*, Oct.

Australia.—Some notes on the development of electrical industry in Australia. The first electrically-driven plant for the recovery of alluvial gold by dredging with centrifugal pumps, has recently been introduced at Sandy Creek in Victoria; the generating plant consists of a 500-kw polyphase steam-driven Stanley inductor alternator. In Sydney an extensive system of electrical distribution of power for pumping sewage has been introduced; the sewage is raised by 21 electrically operated pumping stations into a high-level system, whence it runs by gravity into the ocean. Electric traction is making rapid progress in Australia. In the mining centres electrical development progresses very slowly.—Lond. *Elec.*, Oct. 12.

REFERENCES.

Paris Exposition.—An illustrated description of some engines and generators in the power house of the Exposition, especially of French make; also a description of the power plant at Vincennes.—*Am. Elec.*, Oct.

New Books.

Problèmes sur L'Electricité. By Robert Weber. Third Edition. 1900. Paris: Ch. Beranger. 389 pages, 34 diagrams and 16 tables of data. Paper.

This book is a collection of problems covering the principal branches of theoretical and applied electricity. After a plain statement of the question there follows, in each case, the answer and an explanation of the manner of obtaining the same when not perfectly self-evident. The first set of problems, Section A, under the heading of mechanics and heat, deals with questions of force, work, power, temperature and heat, besides bringing out the relation between mechanical and heat energy. These problems are well chosen and serve as a fitting introduction to the more difficult conceptions of electrical quantities.

The second part of the book, called Section B, is given to problems relating to static electricity covering such matters as Coulomb's law, potential, capacity, surface density, electric field and surface distribution.

Section C, dynamic electricity, is by far the most important part of the book, covering not only the theoretical side of current electricity, but the practical applications as well. The scope of the work can perhaps be appreciated from the fact that the 554 problems of this section are grouped under 33 different headings, the principal subjects touched upon being current, resistance, electromotive force, capacity, the laws of Ohm, Joule and Faraday, the magnetic circuit, storage batteries, dynamos, motors, incandescent and arc lamps, electric lighting, telegraphy and telephony.

The remainder of the book is taken up by definitions of the units as adopted by the international congresses of electricians, followed by sixteen tables of data relating to the physical and electrical constants of various substances.

Besides a great many typographical ellors that are obvious there are the following more serious ones: examples 560, 607 and 657 are not solved properly, and several of the examples on the magnetic circuit determine B from the formula

$$B = \frac{4\pi}{10} \mu \frac{Ni}{l}$$

in which l is taken as only the length of the magnetic circuit covered by the magnetizing winding. In the opinion of the reviewer, it would seem to be more logical to place the definitions of the units first, so that they come before instead of after the problems.

On the whole, however, the examples are well chosen and arranged systematically, and under each sub-heading in order of increasing difficulty, so that the book used in conjunction with the proper text-books would be a great aid to the student and of much service to the teacher.

BOOKS RECEIVED.

The Progress of Invention in the Nineteenth Century. By Edward W. Byrn, A.M. Munn & Company. 480 pages, 300 illustrations. Price, $3.00.

Electric Wiring Tables. By W. Perren Maycock, M.I.E.E. Whittaker & Company. 144 pages. Pocket size. Price, $1.25.

Cassell's Cyclopaedia of Mechanics. By Paul N. Hasluck. Cassell & Company, Ltd. 384 pages, illustrated. Price, $2.50.

Massachusetts Automobile C ub.

The owners of automobiles used for pleasure in Boston and vicinity have formed an association to be known as the Massachusetts Automobile Club. The club has been incorporated and a charter obtained under the laws of the State. The rapid growth in the number of those who own motor wagons and the prospect of a much larger increase in the near future has led to the formation of the club for

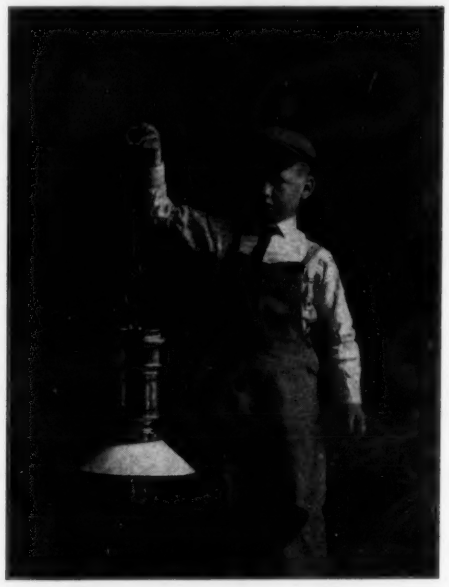
the purpose of looking after their general interests and rights, as well as for the promotion and encouragement of the development of the automobile, and the construction and maintenance of good roads.

It is the purpose of the club to obtain or build a suitable stable and club house for the housing of motor vehicles in the city, and where they may be taken care of in the proper manner. While it is the purpose of the club to protect the interests of owners and users of automobiles, so far as its influence can be exerted against unjust or unreasonable restrictions or legislation, it is also the intention of the club to see that its own members do not violate the rights and privileges of the road.

The general management and control of the affairs of the club are vested in a board of nine directors, with the president, vice-president and secretary as ex-officio members. The following named officers have been elected: J. Ransom Bridge, president; Conrad J. Rueter, treasurer; L. E. Knott, 16 Ashburton Place, Boston, secretary.

Miniature Enclosed Arc Lamps.

The arc lamp shown in the accompanying illustration is only 17 ins. in length and weighs, complete, only 10 lbs. It is manufactured by the Lea Electric Manufacturing Company, Elwood, Ind., and is designed for a consumption of 2½ to 3 amperes. The lamp is operated by means of a solenoid with an iron-clad armature which actuates a lever, to the opposite end of which is connected the dashpot and clutch rod. One of the most important features of the lamp



MINIATURE ENCLOSED ARC LAMP.

is the readiness with which it can be adjusted, both as to resistance and current.

These lamps are meeting with much favor for store window lighting and for use in places with limited space; also for decorative purposes. Carbon of 5-16 in. diameter is used, the upper carbon being completely enclosed. The casing can be slipped off without removing the inner globe. Taken altogether, this is one of the most serviceable little lamps to be found, and its diminutive size renders it particularly advantageous for use in places where it is impracticable to install the ordinary 110-volt lamp.

A Search-Light Baton.

The national political campaign is always provocative of attempts to develop and utilize new ideas in the electrical field, and this year has been no exception to the rule. We have already noted the distribution of campaign oratory by telephone and the circulation of various candidates by means of the automobile, but the most original scheme hit upon thus far is certainly that of using a search-light to lead a mighty crowd in song. At the big rally of the Republican party at Madison Square Garden, New York City, on Friday night, Oct. 26, when some 40,000 people were in the immediate vicinity—if the newspapers are to be believed—it was proposed to have the vast crowd join in singing "The Star-Spangled Banner," "America," etc., but the great problem was how to lead the mighty chorus. This difficulty was solved by our ingenious friend, Mr. Chas. J. Bogue, of 213 Centre Street, who took up a suggestion by Mr. Humphrey in prompt

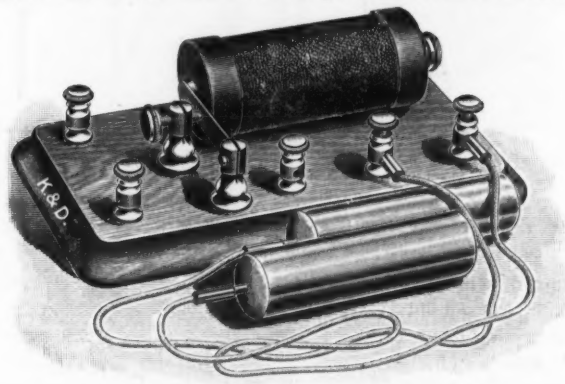
SEARCH-LIGHT BATON.

order. He installed on Madison Square Tower, just below the revolving statue of Diana, and at a height of over 300 feet from the ground, one of his powerful marine projector searchlights, and the beam of this light was used in place of the baton to lead the singing.

The accompanying photograph was cleverly taken by flashlight on the balcony or gallery of the tower, and shows Mr. Geo. L. Humphrey, bandmaster of the Seventh Regiment, N. G. S. N. Y., and musical director of the Madison Square Theatre, in the act of giving the first beat to the assembled bands in the square below, in order to start the singing of "The Star-Spangled Banner." With a very few lessons Mr. Humphrey had caught the knack of handling the searchlight, and the beam was flashed up and down, to and fro, with the utmost ease and precision. The results were most effective and startling, a fact that many thousand people can testify to from the evidence of their own eyes and lungs. So far as we are aware, this was unquestionably the first time that an open-air concert had been led by an arc light beam instead of a baton.

Medical Coil.

Messrs. Kendrick & Davis, Lebanon, N. H., have added a household medical coil to their line of medical apparatus. It is substantially constructed and has platinum contact points. From it three different



MEDICAL COIL.

currents may be obtained, viz., primary, secondary and the two combined. Two colors of silk cord are used and the connections are made with an improved tip. The coil is packed in a neat, hinged and clasped box, which may be used as a carrying case for the instrument. The illustration gives a general view of the coil.

Electric Hoists.

The two accompanying illustrations show views of an electric trolley hoist and an electric traveling hoist recently brought out by the Sprague Electric Company, New York. The trolley hoist (Fig. 1) is operated by two 1-hp standard Lundell enclosed motors. One of the motors is geared to Harrington hoisting mechanism underneath, while the other is geared to the traversing wheels. Both gears are provided with electro-mechanical brakes which are automatically released when the power is turned on and applied when the power is cut off. The control of the motors is effected by means of the pendant chains or cords, there being one cord for each direction of motion on the two motors. The controls are entirely enclosed and are arranged so that they may be provided with automatic limit "cut-offs" which shut off the power when the limits of motion have been reached.

The machine may have a hoisting capacity of 500 or 800 pounds, as desired, the hoisting speed of the smaller load being one foot per second, while that for the heavier load is correspondingly reduced. The traversing speed is six miles an hour. Power is conveyed to the hoist by means of trolley wires. Rawhide pinions are used on these machines to reduce the noise of operation to a minmum. The apparatus complete weighs 750 pounds. It requires a small amount of

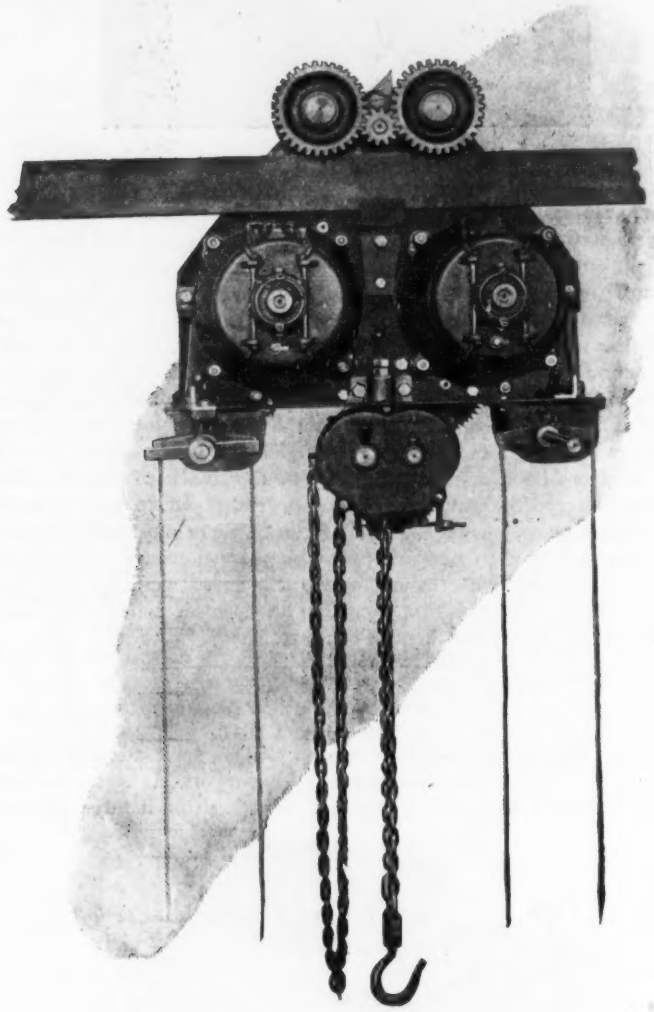


FIG. 1.—TROLLEY HOIST.

head room above the track (7 ins), and the short wheel centres (10 ins) make it possible to turn short curves.

The traveling hoist (Fig. 2) consists of a small truck mounted on flanged wheels which carries the hoisting mechanism, motor and controller. The hoist is a standard Harrington hoist geared to a Lundell standard 1-hp enclosed motor. The controller is of special design, and will operate at several different speeds. It is operated by the pendant cords and handles. The controller, as well as motor and hoist mechanism, is entirely enclosed and the whole apparatus is adapted for use in the open air. The hoist will lift a load of 4000 pounds at a maximum speed of 6 ft. per minute. The truck is arranged for a track of I beams, or similar form, and has a gauge of 21 motor and control is 500 pounds. Fifteen inches head room is required above the track. The motor can be built for any of the standins. The distance between the axles is very short, so that the truck can turn on a comparatively short radius. The traversing of this hoist is done entirely by hand. The total weight of the truck with

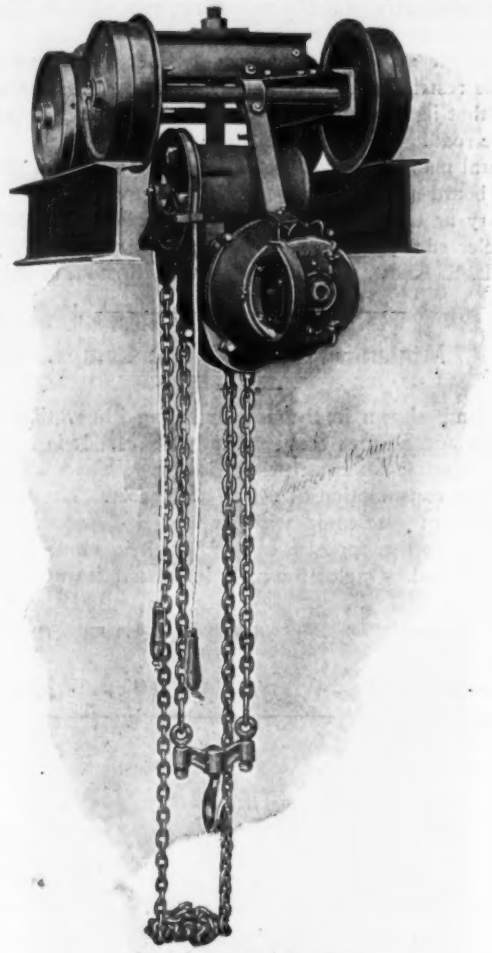


FIG. 2.—TRAVELING HOIST.

ard voltages. Current is conveyed to the truck by means of a trolley wire arranged along the track in any convenient way.

Igniting Apparatus for Hydrocarbon Engines and Automobiles.

The Apple gas engine igniters have been on the market for over four years, and in this time thousands have been sold and are being used daily on gas engines throughout the country. A large per cent of these igniters are used with stationary engines. But since bringing

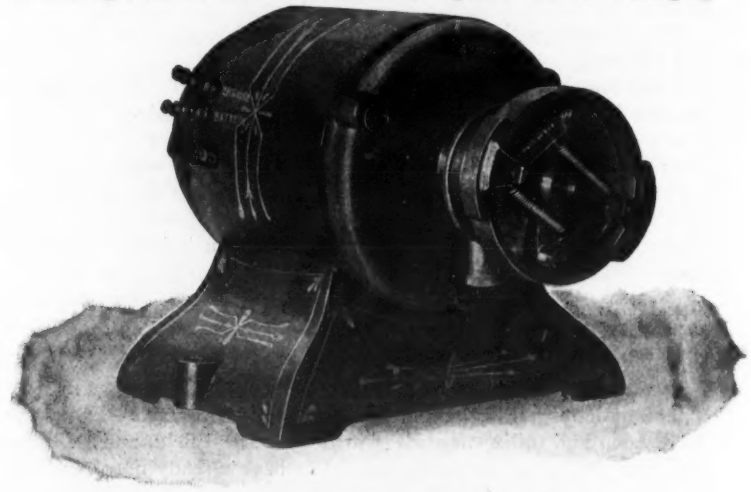


FIG. 1.—IGNITING DYNAMO WITH DOOR OPEN.

out the entirely enclosed dynamo (as illustrated herewith) the sales for portable work has been phenomenal, and the manufacturer, the Dayton Electric Manufacturing Company, Dayton, Ohio, now has a factory with 12,000 sq. ft. floor space with modern machinery capable

of turning out from 75 to 100 igniters of different types per day. The type "E" enclosed dynamo is now used with all types of outfits requiring dynamos. It is entirely enclosed, making it dirt and waterproof, and while being entirely enclosed, means are provided for easy access to its working parts. It is well insulated, there being no dan-

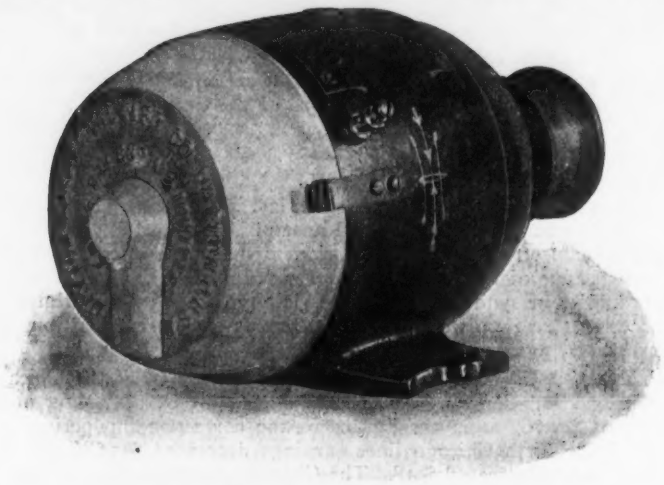


FIG. 2.—TYPE "E" IGNITING DYNAMO.

ger of short-circuit or ground, the mechanical work is the best and it is finished in black japan, all the brass parts being polished.

Fig. 1 shows the type "E" igniting dynamo with door open. The weight of this machine is 20 pounds, and it will operate either touch or jump spark coils as desired. Fig. 2 shows the type "E" igniting dynamo, which is the same as above, with the exception that it has a base which contains a good spark coil entirely sealed with paraffine, thus making it moisture and waterproof.

It is also fitted with a governor pulley which will maintain the speed of the igniter constant, no matter what is the speed of the engine; and where desired, engines can be started without a starting cabinet. The governor pulley operates the same as an engine governor, releasing the friction shoes when the speed is right; it is simple, and provision is made for easy adjustment. This governor is also furnished with the type "E" dynamo without base when desired. The weight of the type "E" with base and coil is 32 pounds.

Fig. 3 represents the starting cabinet, which is a two-cell storage battery made in such a manner that there are no rubber jars or wood box required, thus saving space and danger from breakage. It is entirely sealed, and weighs only 20 pounds, and occupies a space of 10

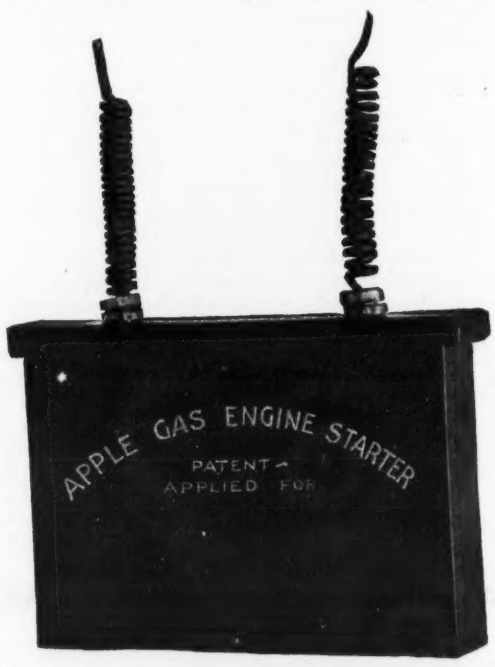


FIG. 3.—STARTING CABINET.

ins. long, 1½ ins. thick and 8 ins. high. One of the principal advantages of this cabinet is that there is not a joint in the entire battery, thus reducing absolutely the danger of poor connections, as is often the case with storage batteries in such service. Where it is not objectionable to carry the little extra weight, the company recommends the use of its starting cabinet rather than dependence on the dynamo alone, as it is a source of reserve power which will spark the engine in case of accident to the dynamo and saves the trouble of turning the engine so often in starting. It provides means besides for testing electrodes in cases where the engine fails to start and enables the operator to easily determine if fault is with the spark mechanism.

It costs nothing for renewals, as it is kept fully charged from the dynamo each time after starting. If directions are followed, it will last as long as the engine it is used with. The company make complete outfits for either touch or jump spark for any kind of engine, together with all attachments for timing and carrying the spark into the engine.

New "Century" Desk Telephone Set.

In the accompanying illustration (Fig. 1) is shown a new form of desk telephone which appeals to users of telephones by reason of its symmetrical design. This is not its only merit, however, for the

FIG. 1.—DESK TELEPHONE.

manufacturer informs us that it is about as nearly perfect, both electrically and machanically, as such an instrument can be made. It is high grade in every respect, and is serviceable as well as attractive in appearance.

These desk sets are manufactured by the Century Telephone Construction Company, Cleveland, Ohio. Each is fitted with this company's new Century transmitter, double pole receiver and a new form of switch hook which is positive and accurate in action. The hook is said to be so substantially constructed that it will not get out of

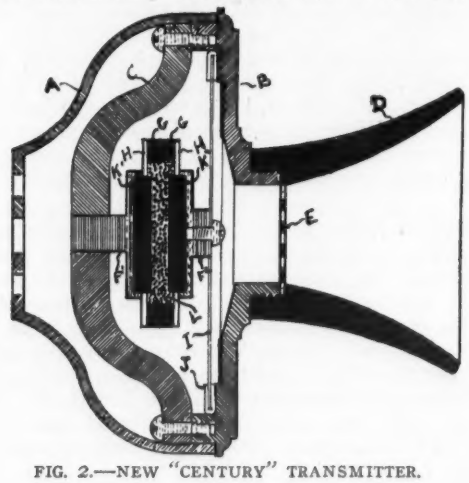


FIG. 2.—NEW "CENTURY" TRANSMITTER.

order under ordinary use. The instrument is furnished with or without generator and extension bell, as desired. The base and metal parts are heavily nickel plated and the stand is covered with polished hard rubber. In Fig. 2 a sectional view of the transmitter is shown.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—The money market, although not really disturbed, showed some nervousness, on the eve of election. Rates are firmer and lenders exhibited a disposition to keep control of their funds. Call money was quoted as high as 20 per cent, though this was merely temporary. The general rate was from 5 to 8 per cent. There was little doing in time money, which is quoted at 5 per cent for all periods. Commercial paper is quiet, prime double names being quoted at 4¾@5 per cent. In the stock market there was a general inclination to reduce speculative engagements, due, it is supposed, to the election, which is the absorbing thought in men's minds. The undertone is, however, good, and there has been some purchasing of stocks, particularly of good investments. Electrical securities were generally lower, trading in these and in outside securities being much lighter. The course of prices in the outside list was in but few instances due to any news in regard to outside stocks. The market was in a position of readjustment, and at the close of the week it appeared that the process of digestion had gone far enough to place the market in a position from which on any resumption of buying it could easily move to a higher level of prices. In some cases prices continued to advance during the week, and some that had reacted from the best prices recorded during the recent upward movement made substantial recoveries. The following are the closing quotations of electrical securities:

NEW YORK.

	Oct. 27.	Nov. 3.		Oct. 27.	Nov. 3.
Gen. Elec.	143¾	142	Elec. Veh.	19	18½
Bklyn Rap. Tran.	62⅛	60⅞	Elec. Veh., pfd.	30	38
Met. St. Ry.	161	158¾	Gen. Car.	4¾	4⅛
Am. Tel. & C.	—	—	Ill. Elec. Veh. Tran.	1¼	1
West. Un. Tel.	81	80¾	N. Y. Elec. Veh. Tran.	7	7
Am. Dist. Tel.	32	35	N. E. Elec. Veh. Tran.	3½	3¼
Com. Cable.	—	—	Tel. & Tel. Co. of Am.	5	5
Elec. Boat	18½	20	Hud. Riv. Tel.	116	116
Elec. Boat, pfd.	39	42	N. Y. & N. J. Tel.	160	160

BOSTON.

	Oct. 27.	Nov. 3.		Oct. 27.	Nov. 3.
New Eng. Tel.	124	123	Erie Tel.	99¾	98
Mex. Tel.	2⅛	2⅛	Gen. Elec., pfd.	139	140
Westing. Elec.	—	*49½	Am. Tel. & Tel.	147¾	148
Westing. Elec., pfd.	62	—	Ed. Elec. Lt.	—	—

PHILADELPHIA.

	Oct. 27.	Nov. 3.		Oct. 27.	Nov. 3.
Elec. Stor. Bat.	75	69	Phil. Elec.	2⅞	2⅞
Elec. Stor. Bat., pfd.	75	75	Pa. Elec. Veh.	3½	4
Elec. Co. of Am.	9⅞	10¼	Pa. Elec. Veh., pfd.	*2	*2
Gen. Elec. Auto.	¼	¼	Am. Rys.	31½	31¼

CHICAGO.

	Oct. 27.	Nov. 3.		Oct. 27.	Nov. 3.
Chicago Edison	—	—	Chicago Telep. Co.	—	—
Chic. City Ry.	—	—	Union Traction.	—	—
Nat'l Carbon	—	—	Union Traction, pfd.	—	—
Nat'l Carbon, pfd.	—	—	Northwest Elev. Com.	—	—

*Asked.

BOSTON ELEVATED.—Gross earnings of the Boston Elevated Railway for the year ended Sept. 30 are nearly $10,150,000. This is an increase of about $490,000 over 1899, and maintains the same ratio of increase as in the year previous. If expenses increased in the same ratio they must have been about $7,000,000, which leaves net earnings of $3,150,000, as compared with $2,844,290 in 1899. Interest from special deposits, taken at its figure in 1899 of $84,000, though it may now be larger, brings the total to $3,234,000. Total charges were $2,615,387, leaving a balance for dividends of $618,613, or a trifle above 6 per cent on the $10,000,000 capital. During the year the company carried 250,000,000 passengers, of whom nearly 50,000,000 were free transfers. The elevated may soon have to face the prospect of increased taxes. With increased earnings comes an increase in the State tax on gross earnings, now ⅞ of 1 per cent, to be increased to 1¼ per cent on the completion of the tunnel from Boston to East Boston.

QUICK SALE OF BONDS.—In 75 minutes, $3,000,000 worth of 5 per cent 50-year gold bonds of the new Southern Traction Company, of Pittsburg, Pa., were sold at the Farmers' Deposit National Bank, Fourth Avenue. It was one of the most remarkable financial transactions in the history of the city. It was at first the intention to hold the sale open for two days, but within an hour and fifteen minutes after the books were opened the entire issue of bonds was exhausted, Pittsburg business men being the purchasers. The Southern Traction Company, it will be remembered, was formerly the West End Traction Company, and bought some time ago by Mr. M. K. McMullin, a local broker, for $4,500,000. The new company reorganized a few days since with the following board of directors: J. D. Callery, president; J. H. Reed, Joshua Rhodes, A. W. Mellon, T. H. Given, P. A. B. Widener and W. L. Elkins.

AMERICAN STEEL & WIRE.—President Clifford says that the election of Mr. P. A. B. Widener to the directorate of the American Steel & Wire Company does not presage any further changes. Mr. Widener has been a stockholder for some time, and his election to the board was urged by a majority of the stockholders. Discussing trade conditions, President Clifford said: "Trade with us is entirely satisfactory, fully as good as last year. I am not prepared to make a comparison of earnings. That is a matter that can take care of itself. Neither am I able to say anything about action of the directors on the common stock." The net earnings of the company for the year ending Dec. 31, 1900, should be about $7,500,000. This will leave a surplus of over $1,000,000, as it takes $6,300,000 to pay the dividends.

WORCESTER STREET RAILWAY CONSOLIDATION.—The Boston and Worcester syndicate which last March secured control of six electric roads, operated in and around Worcester, is now before the Massachusetts railroad commissioners seeking to effect a consolidation of four of its properties for the purpose of more economical operation. The syndicate has in the vicinity of $2,000,000 invested in Worcester street railway properties, but as yet no corporation has been formed to take them over.

CHICAGO UNION TRACTION.—The earnings of the Chicago Union Traction Company for the first 25 days of October show a decrease of $44,767 from the figures of the corresponding period last year. The North Chicago lines earnings decreased $45,686 and the West Chicago increased $918. The Citizens' Street Railway Association of Chicago has brought a mandamus suit against the Secretary of State of Illinois to compel him to issue incorporation papers to the said association.

CHATTANOOGA TROLLEY BOUGHT BY SYNDICATE.—The official announcement was made last week of the consummation of a deal by which the Rapid Transit Company of Chattanooga, Tenn., backed by Philadelphia capitalists, has secured possession of the well-known Crass properties on Lookout Mountain, including the incline railroad from St. Elmo to the top of the mountain and the electric lines on the mountain.

TAMPA ELECTRIC.—Directors of the Tampa, Fla., Electric Company have declared a dividend of 2½ per cent, payable Nov. 15. The dividend was declared from the last six months' earnings. This company was organized Jan. 1, 1900, and operates the street railway and electric light company.

CINCINNATI BELL TELEPHONE COMPANY has increased its capital stock $1,250,000. Part of the new stock will be issued to stockholders as a dividend at the rate of two for five owned, and $510,000 goes into treasury for future acquisitions and work.

Commercial Intelligence.

THE WEEK IN TRADE.—The approach of the presidential election and the unreasonably warm weather have influenced the general trade conditions, the former by increasing conservatism and the latter by checking retail distributive trade. The only exception to the general inactivity was the advance of prices in the iron trade in various sections, and an increasing demand. This is regarded as indicating a general depletion of stocks, as well as confidence in the result of the election. Speculation in various exchanges has been slow. In wheat there was some advance, but this was lost later in the week. Cotton advanced from the low point recorded during the previous week on fears of frost damage. There was a marked improvement in the demand for both crude and finished iron and steel, significant in view of the reported cutting of prices by English and Scotch makers. Actual needs of consumption appear to be the cause of the demand. *Bradstreet's* reports that the failures were more numerous in October than in September, but liabilities were smaller. There were 876 failures reported for the month just closed, an increase of 6.4 per cent over last October, but a decrease of 15 per cent from 1898, of 13 per cent from 1897 and of 29 per cent from 1896. Failures for the week number 165, as against 161 the previous week, 174 the same week a year ago, 183 in 1898 and 223 each in 1897 and 1896. In the New York machinery market there was a fairly steady business, but prices remain unchanged. In the metal market copper is practically unchanged. Lake Superior ingot is quoted at 16¾c., casting stock and electrolytic at 16⅝c.

EXPORTS OF ELECTRICAL MATERIAL.—The following were the exports of electrical material from the port of New York for the week just ended: Argentine Republic—81 cases electrical material, $6,462; 61 cases electric machinery, $3,648. Antwerp—2 cases electros, $177; 34 cases electrical material, $4.248; 3 cases electric motors, $332. Bristol—11 packages electric machinery, $500. Bremen—6 cases electric material, $617; 1 box crane trolleys, $300. British Australia—280 cases electric material, $10,310; 12 cases motors, $520; 3 cases electric machinery, $216. Brazil—13 cases motors and parts, $2,230; 55 packages electric material, $2,309; 16 cases elec-

tric machinery, $2,116. British East Indies—11 packages electric material, $298. Birkenhead—19 packages motor trucks, $3,450. British West Indies—15 cases electric material, $455. Cuba—19 packages electric material, $463. Central America—34 cases electric material, $341. Chili—44 packages electric material, $1,875. Dutch Guiana—2 cases electric material, $40. Glasgow—7 cases eletcric machinery, $560; 57 cases electric material, $994; 10 rolls cable, $2,729. Hamburg—29 packages electric material, $4,217. Hayti—2 cases telegraph supplies, $65. Havre—34 packages electric material, $889; 1 case electric machinery, $48. Liverpool—18 cases electric machinery, $13,318; 43 packages electric material, $5,489; 60 packages trolley poles, $1,511. London—27 cases electric machinery, $908; 106 packages electric material, $7,992. Mexico—82 packages electric material, $781. Manchester—1 case motors, $30; 22 packages electric material, $9,500; 319 packages electric machinery, $17,000. Peru—24 cases electric material, $624. Southampton—8 packages electric material, $178. San Domingo—240 packages electric material, $1,987. Uruguay—1 case electric material, $95. Venezuela—1 package electric material, $14.

SOUTH AFRICA.—J. G. Stowe, Consul-General of the United States at Cape Town, has sent to the State Department an article from the *British and South African Export Gazette* on electrical goods in South Africa, which says: "It will not be many months before the gold mines will be again occupied, and the question of new electrical machinery gone into. Then will it be seen how much of the old machinery has been irreparably damaged by neglect and by water; and, inspired by confidence in the new state of things, orders will go out broadcast for this machinery and for the plant which the mines have been waiting for years to put down. New schemes will be taken in hand, new districts developed, and, what is more, every bit of machinery will be wanted at once." The article describes the change from direct current to polyphase apparatus and says that at first the trade went from the English to the Germans and Swiss. It adds: "To the next thing was but a short step; what more natural than that American dynamos must have American engines to drive them, American pumps to feed the boilers, and to be driven by American motors, and so on *ad lib.* And now the Rand is full of American engineers, American practice is *de rigueur,* and American terms are the vernacular. Specifications are already being handed around for machinery which contain many words strange to our ears, and which clearly indicate their source and the type of machinery required." In a report of his own, Mr. Stowe states that electric and telegraphic material and supplies are in demand.

FIGURES OF EXPORT TRADE.—The American workman is contributing more than a million dollars a day to the export trade of the United States. The products of American workshops exported during the nine months ending with September, 1900, amount in value to $338,678,243, or considerably more than an average of $1,000,000 a day for each day, including Sundays and holidays. Counting only working days, the contribution of American workshops and workmen to the export trade of the United States averages $1,500,000 daily. This grand total of $338,000,000 of exports of manufactures in the nine months ending with September, 1900, is three times as great as in the corresponding months of 1890, and nearly two and one-half times as great in the same months of 1895. In 1890 the exports of manufactures in the nine months ending with September amounted to $113,899,554; in 1895 they amounted in the corresponding months to $145,793,884, and in the same months of 1900 they were $338,678,243. This shows a gain of $32,000,000 in the five years from 1890 to 1895, and of $192,000,000 in the five years from 1895 to 1900. Thus the increase in exports of manufactures in the five-year period, 1895-1900, is six times as great as during the period 1890-95. Full details as to electrical apparatus are not given. Scientific and electrical instruments for the nine months in 1890 were $1,034,408; in 1895 they were $1,525,185, and in 1900 they were $4,849,789.

THE WESTERN TELEPHONE COMPANY, of Chicago, Ill., has recently made shipments of a 600 multiple transfer switchboard and a 600-line combined cross-connecting and lightning arrester board to the Shamokin Valley Telephone Company, of Shamokin, Pa., and 100 line Western express switchboards to the Home Telephone Company, Chillicothe, Ohio, and the Citizens' Telephone Company, Montevideo, Minn. This company is also building a 100-wire addition to a 500 multiple central energy switchboard lately furnished by them to the Schuylkill Telephone Company, of Pottsville, Pa. It has also closed contracts with the Staunton Telephone Company, Staunton, Ill., for a 100 Western express switchboard and 75 magnetos, and with Dr. J. H. Close, New Boston, Ill., for a 100-capacity switchboard; also for a 100-drop switchboard for the Columbia Telephone Company, of Columbia, Pa. Another contract has been closed to furnish the North Oklahoma Telephone Company with a 225-drop switchboard. Orders are strong for the new Western Express No. 3, 5-bar bridging telephones. These instruments are built especially for heavy toll-line work and for farmers' lines.

MR. ALBERT B. HERRICK, the well-known street railway expert, of 120 Liberty Street, New York City, announces that the interest in and demand for the "Herrick electric inspection and testing system" having become so great as to make it impossible for him to longer give it his personal attention and care, he has made arrangements with the instrument house of Elmer G. Willyoung, 82 and 84 Fulton Street, by which the latter will manufacture and market the apparatus under designs approved by Mr. Herrick. Mr. Herrick will personally inspect and furnish a certificate of inspection of each instrument turned out. This instrument has been fully described and pictured in these pages. With this instrument it is possible to make a complete test of car equipments in an extremely short time, and by use of the ordinary help such as is generally found about a trolley station. This instrument is now in use by the following companies, among others: Hartford Street Railway Company, Hartford, Conn.; Albany Street Railway Company, Albany, N. Y.; South Side Elevated Company, Chicago, Ill.; Tramway Company, Milan Italy; British Government Railway, Sydney, Australia; Union Traction Company, Philadelphia, Pa.; North Jersey Railway Company, Newark, N. J.

ELECTRICITY IS KING.—London's new electric underground railroad has so facilitated travel in that city, says *Locomotive Engineering,* as to cause an appreciable falling off in the receipts of the old system of omnibuses. Persons are now moved quickly about, and the 'buses are obliged to bow in submission to the trolley car. The restaurants in the vicinity of the Stock Exchange are also sufferers by the introduction of rapid transit; for many brokers who were obliged to eat in nearby restaurants now find it possible to reach the fashionable West End restaurants in the lunch hour. Beast succeeded man as a bearer of burdens; then came steam, and now the electric motor seems to have triumphed over all these, and ere long will doubtless hold undisputed sway.

LARGE INCREASE OF EXPORTS.—The imports of merchandise during September were valued at $59,562,906, being a decrease of $11,149,059, compared with the same month in 1899. For the nine months ending Sept. 30 the imports were valued at $624,461,506, exceeding by $38,559,108 those for the like period last year. The exports of merchandise for September were $115,634,210, or $5,747,533 greater than those for September, 1899. For the nine months ending Sept. 30 the exports were valued at $1,031,686,401, being an increase of $129,208,901 for the same period last year, and leaving for these months a balance of trade in favor of the United States amounting to $407,224,895.

ELECTRIC RAILWAY CONTRACTS.—President J. D. Hawks, of the Ann Arbor & Jackson Electric Railway Company, has let contracts with the Barney & Smith Company, of Dayton, for 10 50-ft. cars of the latest pattern, equipped with toilet room, smoking compartment and card tables. Contracts have been placed with Westinghouse, Church, Kerr & Company for the equipment of the power plant at Ypsilanti. The high tension system, with sub-stations for reducing the voltage along the line, will be used; and the one power house will also operate the Detroit, Ypsilanti & Ann Arbor Electric Railway.

ELECTRIC LIGHTING IN ENGLAND.—Considerable electric lighting work is projected in various parts of England. The Bermondsey vestry (London) will soon call for tenders for a complete electric and steam equipment for its plant. At Devonport, about $265,000 will soon be expended for electric lighting, and in Lowestoft and Truro the town councils have already secured electric lighting powers. In Lowestoft, $100,000 will be expended in these improvements, and in Truro $87,000. The Bradford Corporation will expend $280,000 in extending its electric light plant.

AXLE LIGHTING.—The Consolidated Axle Lighting Company is running its works at Derby night and day on orders. It has equipment ordered for 100 Atchison cars to be ready early next month, and smaller orders for other companies are in hand. It is found that the use of this system of lighting not only secures good light, but saves something in the cost of keeping cars in good condition, as there is no smoke and no oil to get on the woodwork.

THE LINK BELT ENGINEERING COMPANY, of Nicetown, Philadelphia, has found its steadily increasing business requires the opening of an office at Pittsburg. It has accordingly opened at 1501-2 Park Building, Mr. T. Frank Webster, link-belt engineer, in charge. Mr. Webster will have the care of all business interests in that vicinity for the company.

WINCHESTER, TENN.—On Saturday, Oct. 20, McDowell & Sons had the misfortune to suffer the loss, by fire, of their entire milling plant and electric lighting plant at Winchester, including dynamos, switchboard, etc. They will rebuild at once and are in the market for all the apparatus necessary for the plant.

UNION ELECTRIC COMPANY, of Cazenovia, N. Y., Mr. T. O'Connell, president, is in the market for 10 miles of wire, a 35-kw alternator, station instruments and a large amount of lighting material for arc and incandescent work.

THE GEO. A. FULLER COMPANY has ordered from the Western Electric Company, Chicago, two 100-kw and one 50-kw type "L" dynamos to be installed in the Willard Hotel, Washington, D. C.

General News.

THE TELEPHONE.

HALE, MO.—The Missouri Midland Telephone Company operates a 60-mile toll line.

ST. JOHN, KAN.—The St. John Telephone Company has a 100-drop board and 73 subscribers.

MORRICE, MICH.—The Morrice Telephone Company has a 200-drop board and 150 subscribers.

WENONA, ILL.—The Wenona Telephone exchange operates a 100-drop board and has 75 subscribers.

CAMBRIDGE, MD.—The Home Telephone Company will be organized, with a capital stock of $4,000.

ANDOVER, OHIO.—The Andover Electric Telephone Company has been incorporated. Capital stock, $6000.

OTTAWA, OHIO.—The Putnam Telephone Company has a switchboard capacity of 700 drops and 600 subscribers.

SIOUX CITY, IA.—The Sioux City Telephone Company has been turned over by its stockholders to the Bell Company.

NORTON, KAN.—Mr. H. C. Kelly, manager of the Norton Telephone Company, has 104 subscribers and a projected increase.

CLARIDON, OHIO.—Mr. W. B. Bruce, of the Claridon Telephone Company, informs us that it has a 50-drop board and 31 subscribers.

FORDANIA, KAN.—The Fordania Telephone Company has 120-drop board capacity and 113 subscribers. A new system has been put in.

DETROIT, MICH.—Mr. Sprague, of the New State Telephone Company, reports a switchboard capacity of 100 drops and 58 subscribers.

FAIRBANK, IA.—The Home Telephone Company has several miles of toll line, and operates a 100-drop board here, with 40 subscribers.

DELTA, OHIO.—The Delta Home Telephone Company projects increase of switchboard capacity, the present being 200, with 130 subscribers.

CONROE, TEX.—The Conroe Communication Company has a 50-drop switchboard and 35 subscribers. An increase of 20 per cent is expected.

PARAGOULD, ARK.—The Paragould Telephone Company has a 100-drop board, 50 subscribers, 40 miles of toll line and good business prospects.

LONDON, OHIO.—The London Telephone Company has a switchboard capacity of 410 drops, and 482 subscribers, with a large expected increase.

ROSSLAND, B. C.—Early next spring the Vernon & Nelson Telephone Company will build a direct telephone line from Rossland, B. C., to Cascade.

SANDWICH, ILL.—The Northern Illinois Telephone Company, located at Sandwich, certified to an increase in capital stock from $30,000 to $250,000.

BRYAN, OHIO.—The Bryan Telephone Company reports good business and good prospects. Its switchboard capacity is 400 drops, with 369 subscribers.

ST. MARY, OHIO.—The secretary of the St. Mary Telephone Company reports that his company has 242 subscribers, with a drop board of 350 capacity.

EVART, MICH.—Mr. Bell, of the Citizens' Telephone Company, says prospects are good. It has a fine copper toll line from Marion to Farwell, 45 miles.

PARIS, KY.—The Columbian Telephone Company, of Nashville, Tenn., has purchased the Paris Telephone Company's system, paying therefor about $9,000.

THE CHICAGO TELEPHONE COMPANY is putting telephones in all police stations in that city, this being one of the stipulations in the company's franchise.

SUEZ, ILL.—Mr. Sedwick, of the Suez Telephone Company, informs us that a trunk line is being built from North Henderson to Aledo by Mr. M. W. Moore, of Aledo.

FAYETTEVILLE, ARK.—The Fayetteville Telephone Company is in good shape and operates a 200-drop board, with 180 subscribers. A large increase is expected.

AUGUSTA, WIS.—Mr. J. L. Ball operates a 100-drop switchboard and has 58 subscribers. The plant has been working only a few months, but the outlook is very good.

CLYDE, OHIO.—The Clyde Telephone Company is now building some farmers' party lines and finds prospects very bright. It has a 200-drop board and 175 subscribers.

VERSAILLES, KY.—The Versailles Telephone Company informs us through Mr. Berry, its manager, that it operates a 200-drop switchboard and has 102 subscribers.

HOMER, MICH.—The Homer Telephone Company projects a 25 per cent increase and finds the outlook promising. Operating a 35-drop board, it has 45 subscribers.

CHELSEA, MICH.—Mr. Gorton, president of the Chelsea Telephone Company, states that it has a 100-drop board and 80 subscribers, increased from 16 in one year.

NORTHVILLE, MICH.—The secretary of the Northville Telephone Company sends a favorable account of business. It has a 100-drop switchboard and 95 subscribers.

WASHINGTON, IA.—We are informed that the Washington Telephone Company is in good shape and steadily increasing. It has a 300-drop board and 284 subscribers.

AMSTERDAM, TEX.—The Alvin & Angleton Telephone Company has toll lines of 100 miles connecting Alvin, Angleton, Amsterdam, Velasco, Columbia and other places.

ST. LOUIS, MO.—The Queen City Telephone Company, with capital stock of $50,000, has been chartered by Charles G. C. Haddock, Fred A. Churchill, H. M. Dix and others.

PORTLAND, ORE.—The Columbia Telephone Company operates a 1200-drop board and has 1500 subscribers. It intends connecting with long-distance lines outside the city.

TOCCOA, GA.—The Toccoa Telephone Company informs us through Manager L. P. Cook that its switchboard capacity is 100 drops, and it has some 40 or 50 subscribers.

LAKE ODESSA, MICH.—Mr. G. A. Weed is just putting in a new 120-drop switchboard and rebuilding the exchange. He has 85 subscribers, and reports business flourishing.

SPENCER, IA.—The Spencer Telephone Company contemplates a small increase in its plant. It now has 140 subscribers, its exchange capacity being 250. M. E. Griffin is manager.

PIONEER, OHIO.—The Pioneer Telephone Company has not yet completed installing its plant. It operates a 60-drop board and has 52 subscribers, with a most encouraging outlook.

ELMWOOD, ILL.—The Elmwood Telephone Company operates a 100-drop board and has 51 subscribers. The increase is steady and prospects are good. Mr. M. S. Lott is manager.

PIQUA, OHIO.—The Piqua Home Telephone Company has made a rapid increase, having opened in 1899 with 318 subscribers, and now numbering 650. It has a 700-drop board capacity.

BLOOMINGTON, IND.—Mr. F. S. Shoemaker, superintendent of the Bloomington Telephone Company, informs us that the company operates a 500-drop board and has 415 subscribers.

GEORGETOWN, S. C.—The Georgetown & North Island Telephone Company is a new enterprise recently chartered, with a capital of $1,000. J. B. Steele is secretary and treasurer.

SIOUX RAPIDS, IA.—The Sioux Rapids Telephone Company has been incorporated. Capital, $10,000. Incorporators: C. B. Mills, P. J. Cilley and A. Tymeson, Jr., all of Sioux Rapids.

ALLEGAN, MICH.—Mr. Owen, manager of the West Michigan Telephone Company, informs us that it operates a 150-drop switchboard and has 163 subscribers. The outlook is favorable.

MILLER CITY, OHIO.—The Miller City Telephone Company has only commenced business this year, but is making steady progress and has a favorable outlook. It has 65 subscribers.

GERMANTOWN, OHIO.—The Germantown Independent Telephone Company has an operating capacity of 84 drops and when the installation is completed their subscribers will number 30.

GREENSPRING, OHIO.—The Greenspring Telephone Company has only recently commenced operations with a 75-drop board and 63 subscribers. The building of country lines is contemplated.

DEMOPOLIS, ALA.—Manager N. L. Lee, of the Demopolis Telephone Company, informs us that his company operates a 200-drop board, and has 140 subscribers. It has about 100 miles of toll line.

SPRINGFIELD, ILL.—The Monmouth Telephone Company, of Monmouth, has been incorporated. Capital, $35,000. Incorporators: H. M. Carter, S. W. Worthy and A. Dryenforth, all of Monmouth.

TIFFIN, OHIO.—Mr. Briggs, secretary of the Home Telephone Company, reports a great increase in the number of subscribers, there being at present 813. Its switchboard capacity is 800 separate drops.

COLLINWOOD, OHIO.—The Collinwood Home Telephone Company has 285 subscribers and a large projected increase. It has a 350-drop board and promising business. L. C. Bellanger is manager.

CHARLESTON, S. C.—The Gordon Telephone Company, of Charleston, will will soon construct a long-distance service connecting the sea islands with Charleston. Four submarine cables will be laid.

BALTIMORE, MD.—John Waters has received the contract for the erection of an eight-story brick building for the Maryland Telephone Manufacturing Company, whose plant was burned some time ago.

GREENVILLE, MICH.—Mr. Serviss, manager of the Greenville Telephone Company, notes a remarkable increase in business. It has just put in a new board with 300-drop capacity and has 249 subscribers.

AUBURN, IND.—A careful estimate shows that six-sevenths of the heads of families and business places are subscribers to the local telephone company. This is regarded as evidence of substantial prosperity.

SUMMERVILLE, PA.—The Summerville Telephone Company, with several exchanges in this State, has 950-drop board capacity and about 500 subscribers. There is a steady increase and prospects are excellent.

SAN DIEGO, CALIF.—The San Diego & Back Country Telephone Company informs us through Mr. E. W. Strachan that it does not own any telephones, but rents everything from the Sunset Telephone Company.

CAMBRIDGE SPRINGS, PA.—The Cambridge Springs Electric Telephone & Telegraph Company operates a 200-drop exchange and 30 miles of toll line. It has 235 subscribers, and its business is increasing rapidly.

OAK HARBOR, OHIO.—The Ottawa County Telephone Company projects exchanges at Woodville, Genoa and other places, and has 30 miles of line built. Its switchboard has a 100-drop capacity and it has 100 subscribers.

PIERRE, S. DAK.—The Capital City Telephone Company reports business excellent. Mr. Rowe is manager. The company operates an 80-drop board and has 115 subscribers. The capacity of the plant is to be enlarged.

PRESCOTT, ARK.—Mr. Ashbaugh, manager of the Southwest Arkansas Telephone Company, informs us that the company operates a 100-drop switchboard, with 80 subscribers, and contemplates an increase in plant.

QUINCY, MICH.—F. A. McKenzie, a prominent business man of this city, has been granted a franchise for a telephone system by the City Council. Mr. McKenzie will push the matter and soon organize a big stock company.

MEDINA, OHIO.—Mr. W. B. Croft, of the Medina Telephone Company, sends us the following: The company operates a 200-drop switchboard and has 250 subscribers, with a probable increase of 50 more. This in one year.

VINTON, IA.—The Vinton Telephone Company informs us that prospects never were better. It operates 125 miles of toll line and about 40 farmers' telephones. Its switchboard capacity is 250 drops, and it has 230 subscribers.

MT. VERNON, OHIO.—The Mt. Vernon Telephone Company reports very bright prospects. The superintendent, Mr. E. W. Breece, informs us that the company has a 500-drop board and 433 subscribers, and is projecting a large increase.

EAST LIVERPOOL, OHIO.—The Bell Telephone Company has come to an agreement with the City Council on a franchise. The franchise is for 25 years and the company will use the trolley poles jointly with the street railway company.

NORTHFIELD, MASS.—The Northfield Telephone Company operates under branch line contract with the New England Telegraph and Telephone Company. There is a 20-drop board, and the number of subscribers is 45. Business is satisfactory.

CEDARTOWN, GA.—Mr. J. A. Dodds, manager of the Cedartown Telephone Exchange, reports that his company has switchboard capacity of 200 drops, of which 130 are installed. There are 125 subscribers, and the company operates a 25-mile toll line.

HOYES, MD.—The Garrett County Telephone Company contemplates building a six-mile line between Deer Park and Oakland. It already operates several other lines. Mr. W. A. Smith pronounces the outlook good. The company has 50 subscribers here.

BENZONIA, MICH.—The Benzie County Telephone Company operates a 250-drop switchboard and has 75 miles of line connecting eight villages. Mr. Wayoung, the president, informs us that it has 100 subscribers and expects a very large increase.

NEVADA, IA.—Manager Boardman, of the Nevada Mutual Telephone Company, informs us that it has built several miles of toll line to 11 new towns last summer. Its drop-board capacity is 240, and it has 200 subscribers, with good prospects of an increase.

GREENFIELD, OHIO.—The secretary of the Greenfield Mutual Telephone Company, Mr. Pike, informs us that many improvements are contemplated and a 23-mile toll line is being built to the county-seat. The drop-board capacity is 320, with 271 subscribers.

SAN ANGELO, TEX.—The Rust Bros. Telephone system had 95 subscribers and 60 miles of toll line in 1899. It now has switchboard capacity of 300 drops, 200 subscribers and 550 miles of toll line, with a projected increase of 110 miles and additional subscribers.

AKRON, OHIO.—The Akron People's Telephone Company, which went into operation in July, 1900, makes a splendid showing. The manager, Mr. Frese, informs us that its drop-board capacity is 1200, and 600 more have been ordered. Its subscribers number 1139.

CELINA, OHIO.—The Celina Telephone Company operates a 200-drop "American" switchboard, and has 140 subscribers, 50 being gained within the last six months. Prospects are good to fill the board before the year's end. Mr. H. A. Miller is the secretary.

FLUSHING, OHIO.—Mr. Jenkins, an officer of the Flushing Telephone Company, writes us that it has a 100-drop board and 50 subscribers, but expects to operate full capacity. It has been successful against opposition and is extending lines, and has excellent prospects.

WEST MILTON, OHIO.—Mr. G. Jennings, of the Progress Telephone & Telegraph Company, informs us that its installation is nearly completed, with drop board of 100 capacity, and that toll lines have been put into 10 cities and towns. It opens with very bright prospects.

JEWELL, KAN.—The secretary of the Jewell County Telephone Company, Mr. A. Whitney, informs us that the company has a 100-drop board at Jewell, 100 at Mankato and the same at Burr Oak. There are 152 subscribers, 15 miles of toll line and very promising prospects.

OAKVILLE, IA.—The Oakville Telephone Exchange Company sends us good report of progress through Mr. Edwards. Although a young company, it has a switchboard of 100-drop capacity and 102 subscribers, and the number is increasing daily. Extensions and new exchanges are projected.

DES MOINES, IA.—Two telephone companies have been incorporated. The Sioux Rapids Telephone Company, with headquarters at Sioux Rapids, has a capital of $10,000, and the Buchanan County Telephone Company, whose principal place of business is Independence, has a capital stock of $50,000.

MENTOR, OHIO.—The Mentor Telephone Company has a 100-drop board and 50 subscribers. The company is yet young, but has grown so rapidly that an increase of capital was made during the first year and another is now being carried through to meet increased demands for service and extensions.

SHELBY, OHIO.—The manager of the People's Telephone Company, Mr. C. L. Horak, sends most gratifying accounts of past success and future prospects. Starting in 1899 with 175 subscribers, in one year the number has reached 306. Drop-board capacity is 300, but it will install another 100-drop section soon.

FAIRMONT, MINN.—The Fairmont Telephone Company has a 300-drop-board capacity and 222 subscribers. During the past year an exchange has been put in at Madelia, and that at Sherburn has been reconstructed. Sixty miles of copper metallic circuit toll line have been built. Mr. D. S. Wade is secretary.

SANDUSKY, OHIO.—The Sandusky Telephone Company has switchboard capacity of 3000 lines, installation 1000, and 900 subscribers. Prospects are splendid. The plant has been rebuilt and the system changed. Circuits are all full copper metallic. Two sub-exchanges and 40 miles of toll line are operated.

DEFIANCE, OHIO.—The Northwestern Telephone Company informs us, through Secretary Haymaker, that with a 600-drop board it has 480 subscribers. It has recently expended a large amount in office equipment and line work, and, from present indications, the switchboard capacity will soon have to be increased.

MONTPELIER, IND.—A. D. Wolvernie, a prosperous farmer near this place, is guarding his land with a vicious dog and a shotgun to prevent the Bell Telephone Company from erecting poles thereon. Thus far he has the best of the situation, though several attempts have been made to plant the poles by night.

HENDERSON, TEX.—The Henderson Local & Long Distance Telephone Company operates a 300-drop board and a 100-drop section is being added. It has 311 subscribers and many more in prospect. We are informed that it uses an alternating machine which was invented by the company's electrician, Mr. O. Myres.

CHICAGO, ILL.—A successor of the Hyde Park District Telephone & Electric Company, known as the United Telegraph, Telephone & Electric Company, said to be capitalized at $1,000,000, with a $200,000 plant, has asked the Council for a 25-year franchise to enable it to extend its lines down town and elsewhere in the city and suburbs.

URBANA, OHIO.—The manager of the Urbana Telephone Company, Mr. F. M. Reissnider, informs us that, in addition to its present switchboard capacity of 700 drops, it proposes adding another 100 drops. It has 692 subscribers, of whom 400 have been added in nine months, and it has averaged one order per day for the last three months.

MULBERRY GROVE, ILL.—The Kurtz National Telephone Company, which is an Illinois organization, has voted to increase its capital stock $180,000. This is a parent company and operates exchanges for several towns in this section. The company contemplates the extension of its lines north to Pana, south to Centralia, east to Effingham and west to St. Louis.

OREGON, MO.—The Oregon & Forest City Telephone Company has completed toll lines to Forbes and Heling and several country party lines. This company is about three years old and has 140 telephones to 1000 people. It has just installed another 100-drop American board and is able to give exchange service in both Oregon and Forest City. M. R. Martin is secretary.

BOISE CITY, IDAHO.—Mr. Clement, secretary of the Idaho Independent Telephone Company, informs us that the company has a switchboard capacity of 1500, of which 500 drops are installed. It has 351 subscribers. New lines are projected and others opened as fast as the work can be done, and more subscribers are added with every new line. All this has been done within one year.

SPARTANSBURG, S. C.—The transfer of the Citizens' Telephone Company, of Spartansburg, has been completed, the price paid being $22,500. About $8,000 in improvements will be made on the system. Among the purchasers are L. W. Parker, of Greenville, and L. W. Floyd, of Newberry. These parties and others have also bought out a number of other systems in the upper part of South Carolina.

CHARLOTTE, N. C.—The report to the effect that the Independent telephone systems in the Piedmont section of North and South Carolina would form a consolidation by which the entire system would be placed in close communication has been renewed. The plan proposed seems to be the selection of about four of the principal cities in the above named section, which cities will be made central points for all lines running into them and in this way the entire independent system can be placed in close touch.

NEWARK, OHIO.—An agreement has been reached between the Newark Telephone Company and the citizens of Granville, near this place, whereby the company will finish equipping the Granville exchange. A supplementary franchise is to be granted allowing the local company to carry the wires of the United States Telephone Company through the town. The agreement is the outcome of a protracted fight between the citizens and the United States Company in which the working crews were several times arrested and a large number of poles destroyed.

HUNTINGTON, W. VA.—The rebuilding of the plant of the Huntington Mutual Telephone Company has been completed, and it now has 450 subscribers connected with the exchange. The plant covers Central City, a suburb, and Guyandott, three miles east. The plant is metallic circuit throughout and equipped with American Electric Telephone Company boards and telephones. The rates at all points are $2 for business and $1 for residence telephones. An increase of over 100 per cent has been made in the past four months in the number of working telephones.

WAUCOMA, IA.—The Western Electric Telephone System commenced constructing toll lines about five years ago and has at the present time about 5000 miles of well-equipped toll lines in operation, together with about 40 exchanges. The company has been successful beyond all anticipations. It has purchased a number of smaller companies within the last year and believes that before the independent telephone companies can successfully compete with the Bell they will necessarily be obliged to consolidate their systems in order to make their plants uniform as to apparatus as well as operation. Mr. Charles Webster, vice-president and general manager, mentions as an illustration the case of two of the most important cities in the State and only 80 miles apart, where it is necessary to make five different connections before the line can be used, and then with very little certainty of producing any results. "There is no doubt," he says, "but that the last year has been a very successful one to independent telephone companies, and I look for the movement to continue for several years."

ELECTRIC LIGHT AND POWER.

KIRKWOOD, MO.—The new electric lighting plant which will be built by a St. Louis firm, to cost $20,000, will supply current for three arc lamps and 144 incandescent lamps.

SAN FRANCISCO, CALIF.—One of the largest electric lighting plants ever built on the coast is nearing completion at the Union Iron Works, and will soon be shipped to Honolulu. The plant is of 600 horse-power.

LINTON, IND.—The City Council has voted to erect an electric light plant. H. C. Uhlin & Company, of Indianapolis, will construct and equip the same, which will cost $29,000. The city will issue 29 serial bonds to pay for the plant.

HARRISBURG, PA.—The Keystone Light, Heat & Power Company, of Maxatawny, has been incorporated. Capital, $15,000. Incorporators: D. P. Grimes, J. B. Esser and Dr. I. S. Peters, all of Kutztown; W. Breinig, of Breinigville; T. H. Connell, of Philadelphia.

ROSSLAND, B. C.—Mr. C. H. Mackintosh, of this city, has just secured control of the powers of Stave Lake, in British Columbia, situated about 36 miles from Vancouver. He proposes very shortly to transmit 18,000 horse-power of electrical energy to this city.

PITTSBURG, PA.—The Hughes Light & Heating Company, Pittsburg, Pa., has been incorporated. Capital, $100,000. Incorporators: W. G. Hughes, J. O. Kiskaddow, G. W. Gilmore and J. Armstrong, all of Pittsburg; J. P. Appleman, of Allegheny; J. C. Jamiston, attorney, Pittsburg.

ALTON, ILL.—The property of the Alton Electric Service Company will be sold within the next three weeks by Frank Crowe, the trustee. It is possible the creditors of the company will purchase the power house and all the lines and other belongings and again make an effort to start a company.

PARRY SOUND, ONT.—It is stated that a by-law will be submitted to the ratepayers of the town of Parry Sound, Ont., for authority to raise $20,000 by debentures for the purpose of taking over the electric light plant, now owned by a private company, and to operate the same as a municipal institution.

SPARTANSBURG, S. C.—Geo. E. Ladshaw, of this city, has closed a contract with the Indianola Power Company, of Lancaster, S. C., for the development of the Landsford water power on the Catawba River, where 10,000 horse-power is available. The company will furnish electric power to a number of South Carolina towns.

OTTAWA, ONT.—A deputation from Ottawa has waited upon the Ontario Government for the purpose of obtaining authority of the government to use the power in the Ottawa River, of the rapids at Britannia. The company is known as the Metropolitan Electric Company, and it is said that it intends establishing a pulp mill to be run by electric power.

ALMONT, ONT.—Voting on the by-law to raise by debentures $30,000 to be used in purchasing and installing an electric light plant to be owned and operated by the town of Almont, Ont., took place a few days ago and was carried. Last year a similar by-law was defeated. The mayor is now authorized to issue debentures for $30,000, bearing 4 per cent interest.

SALISBURY, MD.—The Wicomico Falls Light & Power Company has been awarded the contract for street lighting. The contract calls for 256 incandescent 16-cp lamps and seven enclosed arc lamps, burning all night and every night, at $200 per month. The company agrees to furnish additional incandescents at $8.50 per annum and extra arcs at 15 cents per night each.

BROCKVILLE, ONT.—The Town Council has taken over the electric light plant from the Light & Power Company of this place, in accordance with a by-law passed a few weeks ago. The civic commissioners subsequently proceeded to Plattsburg, N. Y., to inspect the electric plant there before deciding upon what steps to take to place the Brockville plant in a perfect, up-to-date condition.

TRENTON, N. J.—The Hunterdon Water Power Company has filed articles of incorporation. Its object is to dam the Delaware River at a point between Kingwood and Frenchtown, with the purpose of generating power to be electrically distributed throughout the surrounding country. The incorporators are E. A. Day, Morristown; W. T. Day, Elizabeth, and Jerome T. Cougelton, Newark. The company starts out with a capital of $2000.

SAN FRANCISCO, CALIF.—Several manhole explosions have taken place in San Francisco, and precautions will have to be taken by the electric light companies and the city authorities. The Independent Electric Light & Power Company has made preparations for forced ventilation of its extensive system of conduits. Four stations will be fitted up, from which air will be forced through the ducts, thus preventing accumulations of gas in the manholes.

THE ELECTRIC RAILWAY.

CHARLOTTESVILLE, VA.—The Charlottesville City and Suburban Railway Company is installing a 125-kw Westinghouse railway generator.

WAYCROSS, GA.—The Waycross & Suburban Railway Company has been organized to build an electric railway in the city and suburbs. It has asked for a franchise.

MILLBURY, MASS.—The Worcester & Blackstone Valley Street Railway Company has leased the Millbury Cotton Mill for a power plant. The capacity is 250 horse-power.

MARION, OHIO.—The citizens of Hookstown have offered a bonus to the South Side Street Railway Company to extend its line to that village. The proposition will probably be accepted.

LEXINGTON, KY.—The Lexington Railway Company has decided to build a branch of its system to a park to be established in the suburbs. R. Lancaster Williams of Richmond is president of the company.

SACRAMENTO, CALIF.—An ordinance was recently introduced in the board of trustees of Sacramento, Calif., requiring street railway companies to equip their cars with glass shields at the ends of platforms for the protection of employees from the weather.

DETROIT, MICH.—Eastern capitalists are working on a scheme to build an electric road between Detroit and Bay City. The road is to be a double-track line, sleeping cars will be placed in service, and the whole equipment of the road will be equal to that of any steam road. Through freight cars will be hauled over the line at night.

CLEVELAND, OHIO.—The car barns of the Cleveland & Eastern Railway Company, at Gates Mills, were destroyed by fire recently, entailing a loss of about $100,000. Seven new cars, recently received from the Jewitt Car Company, and valued at $5,000 each, were lost, as were two steam locomotives formerly used by the company.

YELLOWSTONE PARK.—The Yellowstone Park Railroad Company, with a capital of $2,500,000, has been incorporated at Trenton, N. J., to build railroads through the Yellowstone Park. Among the incorporators are Alexander Morrison, of Hackensack; D. E. Everitt, of Jersey City; J. B. Clark, of Hoboken; F. A. Hall, of Livingston, Mont.

DAYTON, OHIO.—The Dayton & Troy Traction Company has decided to change its proposed route in order to pass through Tippecanoe City. The power house will probably be located at this point. It is also proposed to build a branch line from West Milton to New Carlisle. Valentine Winters and Harry Clegg, of this place, are promoting the enterprise.

IRONTON, OHIO.—The Ohio Valley Electric Company is pushing to completion its road from Huntington, W. Va., to Ironton, having almost all the steel now laid and about all the overhead construction finished. The local lines in Huntington have passed into the control of this company. The Ohio Valley Company intends to rebuild the pole line and string new trolley wire and also furnish power to the local lighting company for street lighting and commercial purposes.

NEW YORK CITY.—Work has begun on the Morris Heights Branch of the Union Railway Company. For several years past the residents of Morris Heights, who are obliged to depend on the New York Central and Hudson River trains to reach the lower part of the city, have been urging the building of this road. The road is really an extension of the Burnside Avenue Branch, which runs from West Farms across 177th Street and Burnside Avenue to Jerome Avenue. It will begin at Jerome Avenue and continue west through Burnside Avenue to the Morris Heights station of the New York Central and Hudson River Railroad. Morris Heights has recently become quite a manufacturing centre, and its population has been increased by the students and professors of the New York University and the Webb Ship Building Institute.

THE AUTOMOBILE.

AUTOMOBILES IN THE CAMPAIGN.—Charles Eckhart, candidate for Governor of Indiana, made his canvass in an automobile.

THE ALTOMOBILE DRIVERS of Chicago have formed a labor union, to be known as Local No. 59 of the International Brotherhood of Electrical Workers.

AUTOMOBILE NEWSPAPER DELIVERY.—The Indianapolis *News* is testing the practicability of employing automobiles in delivering bundles of the paper to country towns throughout the State.

AUTOMOBILE AGAINST HORSE.—The racing during Carnival Week at Indianapolis, between a number of automobiles of different make and a running horse resulted in favor of the horse. The contest was exciting and drew a large crowd.

MIDDLETOWN, CONN.—The large factory and machinery of the Worcester Cycle Manufacturing Company has been sold at auction to the American Surety Company, of New York, the mortgagee, which at once turned over the property to the New York Motor Vehicle Company, which will proceed to manufacture automobiles.

NEW ALBANY, IND.—The first company to do a general cab and hauling business with automobiles in this State has been organized in this city and granted articles of incorporation by the Secretary of State. The company will operate in New Albany and Louisville. The capital is $25,000. Directors are Peter Arlund, J. A. Windsor, W. H. Burvant, Clarence Dellam and G. H. Hester.

SAN FRANCISCO, CALIF.—The Electric Carriage & Transfer Company was recently incorporated to carry on business in San Francisco. The directors are: C. Montgomery, W. H. Jordan, L. H. Johnson, B. F. Ricker and G. T. Montgomery, of San Francisco. The capital stock is $250,000. It is understood that the company will keep automobiles for hire. There is no automobile cab service in this city at present.

THE AUTOMOBILE SHOW at the Grand Central Palace, New York, Nov. 14 to 24, promises to be a very successful affair. A list of the exhibitors suggests, at first glance, that it is a continuation of the Madison Square Garden Show, since many of the exhibits at the latter will be seen at the Grand Central Palace. There will be shown new victorias, broughams, runabouts, racing wagons, theatre buses, traps, stanhopes, carryalls, etc., propelled by electricity, gasoline, steam and liquid air. This show will no doubt prove a great attraction. Manager Marcus Nathan is leaving nothing undone that will make it attractive.

LEGAL.

CEILING FAN PATENTS.—We are informed by the Emerson Electric Manufacturing Company, St. Louis, Mo., that it has filed suit against the Van Nort Bros. Electric Company, of that city. for selling alternating-current ceiling fans made by the Dayton Fan & Motor Company, of Dayton, Ohio. The Emerson Company alleges that, in selling these fans, the Van Nort Company has infringed patents owned by it.

PERSONAL.

MR. H. F. FREVERT, formerly with the Garvin Machine Company, has associated himself with the Niles Tool Works Company, and will be located at the company's general offices and salesrooms at 136 Liberty Street, New York.

MR. GEORGE F. PORTER, who was on the wrecked expedition for laying the Cape Nome Kerite cable, arrived home safely in time to march in the Sound Money parade. He had quite an exciting time in Alaskan waters, but is none the worse for his lively experiences.

MR. W. DAVIS.—Friends of Mr. William Davis, superintendent of the Stromberg-Carlson Telephone Manufacturing Company of Chicago, will be glad to learn that he has so far recovered from his recent long and serious illness as to be on duty at the factory a short time every day.

MR. LEONARD J. LOMASNEY has been appointed general sales agent of the Peerless Rubber Manufacturing Company, 16 Warren Street, New York. Mr. Lomasney is a gentleman of considerable experience, having been connected for several years with the sales department of that company.

MR. FRANK B. RAE, JR., son of the well-known electrical engineer, has started at his father's residence at Ridgewood, N. J., an establishment known as the Alwil Shop, where he is illustrating and publishing special editions of standard poems, etc. He is now putting forth Byron's "Prisoner of Chillon" with Sir Walter Scott's critique as a "foreword."

MR. EDWARD A. WAGNER, who for many years has been connected with the engineering department of the General Electric Company at Schenectady, has accepted a position with the Fort Wayne Electric Company, Fort Wayne, Ind. Mr. Wagner will be closely associated with Mr. J. J. Wood, of the Fort

Wayne Company, and will devote most of his energies to the superintendence of the transformer work.

MR. D. H. LOUDERBACK, of Chicago, is on his way to London, where he is to take charge of the Charing Cross Underground Railroad, in which Charles T. Yerkes and other Chicago and Eastern capitalists are interested. He will be the personal representative in London of the American syndicate, and will assume the direction of work as soon as he arrives there. Mr. Louderback was selected to go to London because of his long experience in the planning, promoting and building of street and elevated railroad systems in Chicago.

PRESIDENT CHARLES J. GLIDDEN, of the Erie Telephone system, says that he fully appreciates the courtesy extended to him in mentioning his name in connection with the presidency of the American Bell Telephone Company, and that, should he be honored with an offer of the position, he could not accept, as his entire time is taken in connection with the Erie system, the continued success of which will be the height of his ambition. Of the total number of telephones and transmitters under rental by the American Telephone & Telegraph Company, the Erie Telephone system on Oct. 1 was using 292,336.

OBITUARY.

GUNDAKER.—Charles A. Gundaker, who had charge of the sales of incandescent lamps and meters in the New York office of the General Electric Company, died at his home in Newark on Wednesday, Oct. 31. The immediate cause of his death was peritonitis. Mr. Gundaker's connection with the electrical industry dates back to 1881, when he began work at Mr. Edison's lamp factory at Menlo Park. He was then but a boy. The lamp factory had been going a little over a year, having been started in 1880. From the lamp factory Mr. Gundaker was transferred to the New York office of the Edison General Electric Company in 1891, being placed in charge of lamp sales. After the formation of the General Electric Company, through the consolidation of the Thomson-Houston and Edison companies in 1893, Mr. Gundaker took charge of meters as well as lamps for the supply department of the New York office of the new company. He remained in that position until his death. Mr. Gundaker was a thorough master of all the details of his business, a good comrade, a first-class salesman, and a man liked and respected by all who came in contact with him. Mr. Charles T. Hughes, the manager of the New York local office of the General Electric Company, was deeply grieved to receive word of Mr. Gundaker's death, breaking as it did a friendship which had continued without interruption for almost 20 years. The funeral services were held in Newark on Nov. 2.

EDUCATIONAL.

FREE LECTURES.—The Department of Education for the Boroughs of Manhattan and the Bronx is giving free popular lectures at St. Bartholomew's Lyceum Hall, 205 East Forty-second Street; the Baron de Hirsch Trade School, 222 East Sixty-fourth Street; Cooper Institute, and Public School 86, Lexington Avenue and Ninety-sixth Street. The range of subjects of these lectures is a wide one, and embraces travel, physics and electricity, European geography and American history and civics. The lectures on electricity are as follows: At St. Bartholomew's Lyceum Hall, Static Electricity, by W. W. Ker, Dec. 1; Magnetism, by W. W. Ker, Dec. 8; Generation of Electricity, by W. W. Ker, Dec. 15. At the de Hirsch School, W. W. Ker, Nov. 14, Incandescent Electric Lighting; Nov. 21, Electroplating and Electrotyping; Nov. 28, Electrical Methods of Communication. All of the lectures of the courses are free.

Trade Notes.

NEW STATION.—The structural steel work of the Germantown Junction Station of the Pennsylvania Railroad will be furnished by the American Bridge Company.

AUTOMATIC INJECTOR.—The Lunkenheimer Company, Cincinnati, Ohio, describes its automatic injector in a circular just issued. This injector is now being placed upon the market.

THE ELECTRICAL CONSTRUCTION COMPANY, London, Ont., is asking for tenders for the erection of a new factory. This company from a small concern has risen to great proportions, and forms another important addition to the manufacturing interests of the city of London.

RAILWAY STORAGE BATTERY PLANT.—Circular No. 60 of the Electric Storage Battery Company contains a reprint from the columns of the ELECTRICAL WORLD AND ENGINEER, of Oct. 6 last, of the article on the Storage Battery Plant of the Woronoco Street Railway Company, at Westfield, Mass.

THE SIEGRIST LUBRICATOR COMPANY, of St. Louis, has been awarded a contract to equip all machinery of the Lacombe Electric Company, of Denver, with its Siegrist automatic oiling system. This contract was awarded after a careful investigation of such devices by the City Construction Company, of Denver.

SILICA-GRAPHITE PAINT.—The Joseph Dixon Crucible Company, Jersey City, N. J., manufactures, among its well-known graphite products, silica-graphite paint for the protection of steel viaducts, bridges and buildings exposed to the sulphur fumes of railroad engines. Managers of trolley roads will be interested in this subject.

THE PHILLIPS ELECTRIC WORKS.—The business of the Eugene F. Phillips Electric Works, at Montreal, Quebec, has so largely increased that the manufacturing capacity of its plant has become altogether inadequate, and arrangements are being made to enlarge the factory. For many months past the works of this concern have been operated day and night.

MR. JAMES G. BIDDLE has removed from the Drexel Building to Room 1024 Stephen Girard Building, Philadelphia. Mr. Biddle's new office is thus very centrally located and the change should be of convenience to many of his customers. The Stephen Girard Building is on Twelfth Street, between Market and Chestnut Streets, very near to the Pennsylvania and Reading railroad stations.

"PUMPS FOR EVERY SERVICE" is the title of a catalogue of 344 pages just issued by the Goulds Manufacturing Company, Seneca Falls, N. Y. It covers this company's entire line of manufactures, ranging from small hand and house pumps up to large water-works pumps. It is a very complete work and is profusely illustrated, and the index is very complete and carefully arranged. The Goulds Company will be pleased to send copies to the trade on application.

THE H. C. ROBERTS ELECTRIC SUPPLY COMPANY, Philadelphia, has just sent out its November calendar blotter. The blotter this time is very artistically gotten up, showing three little girls on their way to school in a thunderstorm. Accompanying this blotter Mr. Roberts has sent out circulars descriptive of the Roberts fixture block, the flush cone cluster body, Roberts weatherproof street hood and a circular descriptive of Brunt's latest improved regulating socket.

A NEW INDUSTRY IN WARREN.—The Economy Electric Company, recently organized in Warren, Ohio, has begun business. It has erected a new building, 30 x 80 ft. and two stories high, and will make a specialty of renewing burned out incandescent lamps. The factory is equipped with the most modern machinery and apparatus used in carrying on this class of work. Mr. J. W. Holloway is the manager of the new company. The company starts business with a bright outlook, and already has 50 persons in its employ.

A MAMMOTH CATALOGUE.—The new catalogue of machine tools and attachments just issued by Manning, Maxwell & Moore, 85 Liberty Street, New York, is of unusual interest by reason of its size as well as the variety of its listed contents. The book is of imperial quarto size (10 x 13 in.), contains 700 pages and is substantially bound in cloth. It represents only a part of the business, however, and illustrates only metal working and woodworking machine tools and their appliances. The catalogue is supplied with a telegraphic code, by the use of which telegraphic and cable communications may be greatly condensed. Some idea of the proportions of this book may be obtained from the fact that it contains 2081 illustrations of as many different machines, each illustration being accompanied by dimensions of the machine or device shown. The index is very complete and arranged with care.

ANNUAL BANQUET.—The annual banquet given by the Warren Electric & Specialty Company, of Warren, Ohio, to its employees, took place a few nights ago in the new building of the Economy Electric Company, which is near the Warren Company's factory. Both buildings were brilliantly lighted and covers were laid for 250 guests. At the conclusion of the dinner Mr. T. H. Gillmer, president of the Warren Company, in response to numerous calls, made a speech full of fraternity and good fellowship. Speeches were also made by Mr. E. W. Gillmer, secretary and treasurer of the Warren Company; Col. E. E. Nash, vice-president of the Colonial Electric Company, Ravenna, Ohio; J. W. Holloway, the new manager of the Economy Electric Company, and others. After the speechmaking the rest of the evening was spent in dancing. The entertainment was a great success and every one had a good time. The Warren Electric & Specialty Company gives its employees a banquet every year, this being the fourth.

Record of Electrical Patents.

UNITED STATES PATENTS, ISSUED OCT. 30, 1900.

[Conducted by William A. Rosenbaum, Patent Attorney, Times Bldg., N. Y.]

660,551. ELECTRIC FAN; J. M. Beswick, New York, N. Y. App. filed May 8, 1900. Relates principally to the construction of the motor containing case and its supporting standard.

660,561. ELECTRIC INDICATOR; C. L. Clarke, Rye, N. Y. App. filed July 10, 1900. Comprises two alternating-current motors having energizing coils upon their armatures connected to a source of continuous-current supply, and a stroboscopic system having each of its elements independently operated by one of said motors.

660,572. TELEPHONIC APPARATUS; R. Gunther, Vienna, Austria. App. filed Nov. 18, 1898.

660,613. PROCESS OF AMPLIFYING ELECTRIC CURRENTS; J. B. Baker, Newton, Mass. App. filed Nov. 23, 1899. A process of generating amplified varying signaling-currents which consists in causing a conductor to so move in a magnetic field, which is generated in whole or in part by the varying signaling-current, that the electromotive force generated in the moving conductor is independent of the position of the conductor within the magnetic field.

660,620. NON-INTERFERENCE SIGNAL BOX; F. W. Cole, Newton, Mass. App. filed Nov. 13, 1899. Details relating chiefly to the transmitter.

660,633. ELECTRIC SNAP SWITCH COVER; M. Guett, Hartford, Conn. App. filed June 27, 1900.

660,634. ROTARY SNAP ELECTRIC SWITCH; M. Guett, Hartford, Conn. App. filed June 27, 1900.

660,659. SHAPED SPOOL FOR DRUM ARMATURES; A. Rothert, Riga, Russia. App. filed Jan. 30, 1900. A combined shaped coil for drum-armatures containing several elements having equal or unequal numbers of turns and having the armature wire wound on suitable formers in sufficient number of turns for all the elements forming one coil or winding member, the said wire being of suitable cross-section and severed at suitable points, the whole coil being thus sub-divided into several elements having each the number of

turns comprised between two severed points—that is, between one of the said points and beginning or end of the wire.

660,693. ART OF MANUFACTURING CARBON; H. Wartenberg, Chicago, Ill. App. filed Dec. 16, 1899. The improvement in the art of manufacturing carbon, which consists, first, in saturating or impregnating a suitable fiber with a chemical mixture formed by combining water and a saccharine ingredient with sulfuric acid, tartaric acid and carbonate of ammonia, and then subjecting the fibre to heat.

660,713. ELECTRIC MOTOR; T. E. Watson, Milwaukee, Wis. App. filed Oct. 4, 1899. Relates particularly to dental tools, the motor being conveniently mounted in a vertical standard and completely closed in.

660,724. ELECTRIC CONVEYING AND ELEVATOR APPARATUS; G. F. Fischer, Salt Lake City, Utah. App. filed Aug. 23, 1899. Structural details of apparatus whereby a tramcar may be run from one level to an elevator car and raised or lowered to another level.

660,738. THIRD RAIL FOR ELECTRIC RAILWAYS; B. C. Seaton, St. Louis, Mo. App. filed March 5, 1900. Provides for protecting the third rail from the weather and accidental contact and consists of continuous guards or shields on both sides of the rail, one of which extends upwardly and over the upper surface of the rail.

660,741. APPLIANCE FOR MAKING METALLIC CONNECTIONS BETWEEN ELECTRIC CONDUITS; A. F. Watkins and R. Lenk, New York, N. Y. App. filed March 13, 1900. Details.

660,795. ELECTRIC ARC LAMP; C. E. Harthan and G. E. Stevens, Lynn, Mass. App. filed Nov. 2, 1898. Details.

660,796. HYGIENIC RESONATOR FOR TELEPHONES OR OTHER SOUND-TRANSMITTING DEVICES; G. Hoglund and C. M. Hedman, Chicago, Ill. App. filed Dec. 18, 1899. A resonator for a sound-transmitting device comprising a concave piece with its cavity circumscribing and adjacent to the opening of the transmitter.

660,826. TELEPHONE CALL RECORDER; H. D. Stroud, Chicago, Ill. App. filed Feb. 23, 1900. Provides mechanism for automatically registering the call of each subscriber and indicating how many calls have been made; also for registering the calls of each station at a common reading station and for resetting the mechanism from the reading station.

660,836. ELECTROGALVANIC BATTERY; H. J. Brewer, New York, N. Y. App. filed July 7, 1899. Consists in forming the opposed surfaces of the carbon electrode and of a slab of conglomerate material in such manner that they interlock and hold the conglomerate against longitudinal or vertical displacement.

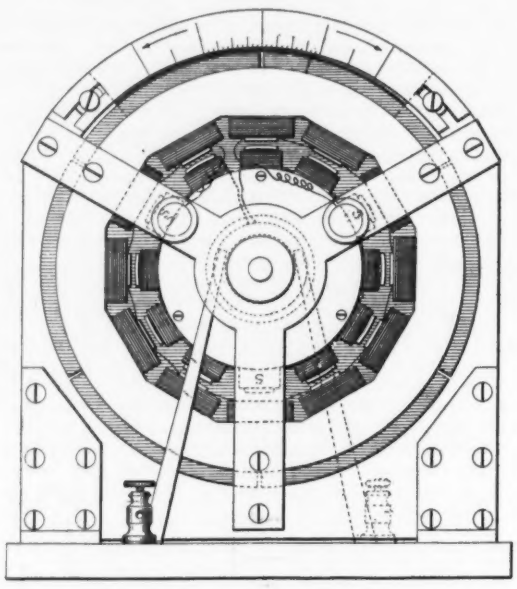
660,842. ILLUMINATED FLOWER; W. A. Church, Pittsburg, Pa. App. filed Feb. 13, 1900. An artificial flower having a miniature electric lamp embedded in its centre.

660,852. ELECTRODE FOR ARC LAMPS; F. Hachmann, St. Paul, Minn. App. filed Dec. 22, 1899. An electrode for an electric arc lamp comprising a tubular shell of hard carbon, and a filling of calcium carbid with an adhering and binding material.

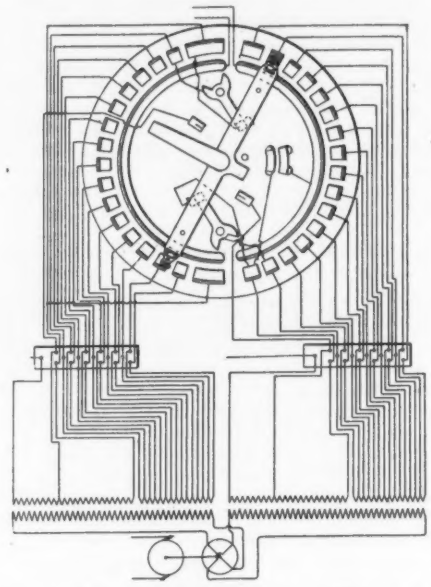
660,867. ELECTROMAGNETIC TOOTH-STOPPING HAMMER; C. Ostmann, Breslau, Germany. App. filed June 5, 1899. A dental plugger comprising an electromagnet provided with circuit-terminals, said electromagnet being provided with a two-part core of magnetizable material, one part adapted to carry a dental tool and the other carrying a circuit-breaking contact, both sections being elastically mounted.

660,878. INSULATING SUPPORT FOR SWITCHBOARD CONDUCTORS; G. Wright and C. Aalborg, Wilkinsburg, Pa. App. filed Jan. 2, 1900. An insulating support for switchboard conductors having an oblong central aperture, transverse side grooves, a continuous recess surrounding the aperture at one end and a corresponding boss on the opposite end.

660,884. METAL-DEPOSITING APPARATUS; H. R. Boissier, New York, N. Y. App. filed April 4, 1900. Structural details.



660,561.—Electric Indicator.



660,930.—Method of Varying Active Lengths of Electrical Conductors.

660,801. ELECTRICALLY OPERATED MACHINE TOOL; J. Riddell, Schenectady, N. Y. App. filed Aug. 30, 1900.

660,803. MEASURING INSTRUMENT; F. Schrottke, Berlin, Germany. App. filed Sept. 2, 1899. A method of correcting errors in alternating-current measuring instruments, which consists in setting up lines of force by the current that is to be measured, subjecting a movable element of the instrument to said lines of force, and adjusting the reluctance in the magnetic circuit threaded by a portion only of said lines of force.

660,804. MEASURING INSTRUMENT FOR ALTERNATING CURRENTS; K. O. F. Schrottke, Berlin, Germany. App. filed Sept. 2, 1899. An alternating-current measuring instrument comprising a movable member, and a field portion having a winding for association with an alternating-current circuit, and a rotatably adjustable portion adapted to vary the reluctance of a part only of the magnetic circuit, including the field portion.

660,815. ELECTRIC DISTRIBUTION SYSTEM; E. M. Hewlett, Schenectady, N. Y. App. filed July 23, 1900. Provides for the interconnection of a polyphase alternating-current circuit with a single-phase circuit, so as to transfer the latter to any desired pair of mains of the alternating-current circuit, which is accomplished by means of two single-pole, double-throw switches, the connections of the alternating-current mains and contacts cooperating with the switches being such that by varying the position of the switches any pair of polyphase mains may be connected in conducting relation to the single-phase circuit.

660,816. PRODUCING HIGH VACUUM; J. W. Howell, Newark, N. J. App. filed Aug 31, 1899.

660,818. ELECTRIC SWITCH; C. H. North, Cleveland, Ohio. App. filed Nov. 15, 1899. (See page 733.)

660,819. MAGNETIC SIGNAL; C. H. North, Cleveland, Ohio. App. filed April 21, 1900. (See page 733.)

660,820. MAGNETO ELECTRIC GENERATOR; C. H. North, Cleveland, Ohio. App. filed Aug. 24, 1900.

660,907. SINGLE-PHASE, ALTERNATING-CURRENT GENERATOR; B. G. Lamme, Pittsburg, Pa. App. filed May 24, 1899. (See page 732.)

660,908. VARIABLE SPEED ELECTRIC MOTOR; B. G. Lamme, Pittsburg, Pa. App. filed June 5, 1899. (See page 732.)

660,909. ELECTRIC MOTOR; B. G. Lamme, Pittsburg, Pa. App. filed Sept. 14,1890. (See page 732.)

660,910. SYSTEM OF ELECTRICAL DISTRIBUTION; B. G. Lamme, Pittsburg, Pa. App. filed April 14, 1900. (See page 732.)

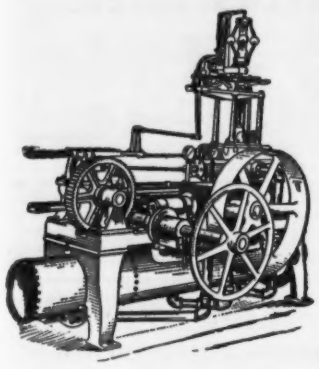
660,911. ALTERNATING-CURRENT INDUCTION MOTOR; B. G. Lamme, Pittsburg, Pa. App. filed April 14, 1900. (See page 732.)

660,930. METHOD OF VARYING ACTIVE LENGTHS OF ELECTRICAL CONDUCTORS; C. F. Scott, Pittsburg, Pa. App. filed Aug. 21, 1897. The method of varying the electromotive force supplied by a transformer which consists in gradually cutting in or out a sub-divided portion of either the primary or the secondary winding of the transformer, and when such portion is all inserted or cut out, simultaneously cutting out or reinserting said portion and inserting or cutting out another portion of substantially the same length.

660,979. ELECTRIC ACCUMULATOR OF SECONDARY BATTERY; Henri Weymersch, Paris, France. App. filed Feb. 19, 1900.

660,987. ELECTRICITY METER; P. Eibig, Berlin, Germany. App. filed Oct. 7, 1899. Relates to meters which have a regular reciprocating movement of a pressure coil and consists in arranging the swinging coil so that it becomes effective only in one direction of movement, being returned after each oscillation in that direction by means of an electromagnet automatically excited at that moment.

661,020. ELECTRIC RAILWAY SYSTEM; B. E. Osborn, Auburn, N. Y. App. filed April 5, 1900. Comprises a series of contact stands which are normally "dead," each stand carrying an oscillating lever adapted to be thrown into contact with a prime conductor when a shoe carried by the car depresses the lever, and so deliver current to the car.



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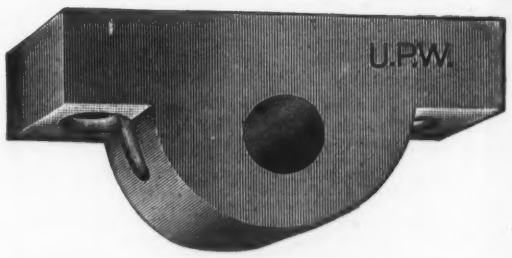

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1 D.C. Voltmeter, double scale, 0-5 and 0-150.
1 D.C. Voltmeter, double scale, 0-15 and 0-150.
2 A.C. and D.C. Voltmeters, double scale, 0-75 and 0-150.

GREGORY ELECTRIC CO.
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SPECIAL SALE OF FINE TESTING INSTRUMENTS FROM THE ENGINEERING DEPARTMENT OF SIEMENS & HALSKE.

Probably the Finest Equipment of Testing Apparatus Ever Installed in any Factory.

Most of these instruments were purchased just prior to the absorption of this company by the General Electric Co. and have never been used. This exceptional lot of instruments should appeal especially to colleges and schools desiring to increase their equipment with the finest instruments at a small expenditure.

1 D.C. Voltmeter, double scale, 0-300 and 0-600, with multiplier.
1 D.C. Voltmeter, double scale, 0-150 and 0-600, with multiplier.
1 D.C. and A.C. Voltmeter, double scale, 0-300.
2 Millivoltmeters, 0-3000.
1 A.C. and D.C. Voltmeter, three scale, 0-25, 0-250 and 0-625, with multiplier.

WESTON STANDARD PORTABLE AMMETERS.

1 D.C. Ampere Meter, 0-5.
1 " " 0-15.
3 " " 0-25.
2 " " 0-50.
2 " " 0-100.
2 " " 0-200.
2 " " 0-500.

NEW WESTON STANDARD WATTMETERS WITH RESISTANCES.

1 2-ampere 150 or 75 watts.
1 100 " 7500 and 15,000 watts.
1 10 " 1500 " 7500 "
1 25 " 1500 " 3000 "
1 50 " 7500 " 3750 "
1 200 " 15,000 " 30,000 "

DYNAMOMETERS.

1 Queen 229 F.
1 Siemens & Halske 46—16 amp. mounted on wood.
1 Siemens & Halske 89—31 amp. mounted on wood.
1 Siemens & Halske 4½—1-6 amp. mounted on wood.
4 Siemens & Halske, metal and glass case.
1 Siemens & Halske Dynamometer wattmeter, 4000 watts with multiplier.
1 Siemens & Halske Dynamometer wattmeter, 600 watts with multiplier.

MISCELLANEOUS INSTRUMENTS.

1 Hoyt's (Whitney) A.C. and D.C. portable wattmeter, 7500-1600 watts.
1 Hoyt's (Whitney) portable ammeter 0-5 amperes.
1 Hoyt's (Whitney) A.C. milliammeter 0-500, portable.
1 Stanley portable D.C. and A.C. 0-50 and 0-500 ammeter with shunt.
1 Jewell portable voltmeter 0-300 volts D.C.
1 Schuyler portable voltmeter 0-700 volts D.C.
1 Wirt portable voltmeter with Clark standard cells.
1 Cardeu A.C. and D.C. portable voltmeter 0-120 volts, brass case.
1 Cardeu A.C. and D.C. portable voltmeter 0-120 volts, aluminum case.
6 Siemens & Halske plug resistances for laboratory testing.
2 32 cell chloride of silver testing batteries.
1 Standard resistance, 1 to 10 ohms.
3 Greely decimal pattern Wheatstone bridge testing sets, 1-1000 to 11 million ohms, complete with galvanometer and contact keys.
1 Queen & Co. testing set, style T 307, 1-1000 to 11 million ohms, complete as above.
1 reflecting galvanometer with 8 coils, Siemens & Halske, very fine.
1 Thompson reflecting low resistance tripod galvanometer.
1 Wiedeman pattern galvanometer, dead heat.
1 Ruhmkorff induction coil 1½ in. spark with condenser.
1 Belted Tachometer.
1 Astatisches electro-dynamometer, very fine.
2 McDonnell odometers.
1 Bristol recording voltmeter, 150 volts.
1 Bristol recording ammeter, 150 amperes.
2 Crosby steam engine indicators.
1 6-in. micrometer S. T. D. Co., very fine.

220-VOLT MOTORS.

1 1 H.P. E. & C., self-oiler, M.P.
1 2 " Lundell, self-oiler, slow speed.
1 2½ " Holtzer-Cabot, self-oiler.
3 3 " Sprague, self-oilers.
1 3 " Kester, self-oiler.
1 3 " Crocker-Wheeler, self-oiler.
1 3 " Gen. Elec., type I.B., s. o.
1 3 " T.-H.
1 3 " C. & C., self-oiler.
2 3 " Card, slow speed, self-oilers.
1 5 " Eddy, ring type, self-oiler.
1 5 " Westinghouse, self-oiler.
2 5 " Westinghouse, s. o., M.P.
1 7½ " Eddy, self-oiler.
2 7½ " Edison, 6 K.W., self-oilers.
1 10 " Eddy, s. o., new armature.
1 10 " Eickmeyer, elevator motor.
1 10 " Lundell, self-oiler.
1 10 " Westinghouse, M.P., s. o.
1 12 " Lundell, 10 K.W., M.P.
1 15 " Eddy, self-oiler, new arm't.
1 15 " Edison, self-oiler, 12 K.W.
1 15 " Mather, ring type, new arm't.
1 18 " Edison, self-oiler, 15 K.W.
1 30 " Edison, self-oiler, 25 K.W.
1 50 " Northern, M.P., s. o., new

500-VOLT MOTORS.

1 1 H.P. C. & C., self-oiler.
1 2½ " Holtzer-Cabot, self-oiler.
1 3 " Toledo, self-oiler.
1 3 " Hobart, self-oiler.
1 5 " Westinghouse, M.P., s. o.
1 7½ " T.-H., new armature.
1 7½ " Eddy, type C, self-oiler.
1 10 " C. & C.
1 10 " Commercial, self-oiler.
1 10 " Card, M.P., s. o., s. s.
1 10 " Eddy, M.P., s. o., s. s.
1 10 " Westinghouse, M.P., s. o.
1 15 " Commercial, self-oiler.
1 18 " Thomson-Houston, self-oiler.
2 18 " Edison, 15 K.W., self-oilers.
2 18 " C. & C., self-oilers.
1 20 " Commercial, self-oiler.
1 20 " Card, self-oiler.
1 30 " Thomson-Houston, self-oiler.
1 40 " Mather, self-oiler.
2 60 " Edison, 45 K.W., self-oilers.

DYNAMOS = MONEY SAVERS! = ENGINES

ALTERNATORS.

One 30 K.W. National, 1100 volts.
One 30 K.W. Westinghouse, 1100 volts.
Four A-35 T.-H., 1100 volts.
Two A-70 T.-H., 1100 volts.
Two A-30 T.-H., 1100 volts.
Two A-60 T.-H., 2280 volts.
One 60 K.W. Stanley Inductor, 1000 to 2000 volts.
One 150 K.W., 60-cycle Westinghouse, 1140 volts.
One 240 K.W. General Electric, 1140 volts.
One 400 K.W. General Electric, 6600 volts.
One 60 K.W. Westinghouse, 2000 volts.

MOTORS—ALTERNATING CURRENT.

One 5 H.P., type C Westinghouse, 200 volts.
One 20 H.P. G. E., 2-phase, 500 volts.
One 30 H.P. G. E., 3-phase, 100 volts.
One 10 H.P. Excelsior, single-phase, 100 volts.
One 5 H.P. Ft. Wayne, single-phase, 100 volts.
One 10 H.P. Westinghouse, type C, 200 volts.
One 15 H.P., type C, Westinghouse, 200 volts.
One 10 H.P. General Electric, 3-phase, 220 volts.
One 25 H.P. Westinghouse, type C, 200 volts.
One 50 H.P. Stanley, 500 volts.
One 20 H.P. Stanley, 500 volts.

110-VOLT DYNAMOS.

One 5 K.W. Eddy, direct connected to Case engine.
One 25 K.W. Eddy, direct connected to Russel engine.
Two 12 K.W. Edison bi-polar.
Four 15 K.W. Edison bi-polar.
Four 20 K.W. Edison bi-polar.
Three 25 K.W. Edison bi-polar.
Four 30 K.W. Edison bi-polar.
Two 45 K.W. Edison bi-polar.
One 60 K.W. Edison bi-polar.
Two 100 K.W. Edison bi-polar.
One 150 K.W. Link Belt.

ENGINES.

One 10 x 12 Russell Automatic.
One 14 x 18 Russell Automatic.
One 10 x 12 Armington & Sims.
One 12 x 12 Armington & Sims.
One 13 x 12 Armington & Sims.
One 75 H.P. Westinghouse, Jr.
Three 60 H.P. Westinghouse Standard.
One 250 H. P. Westinghouse compound.
One 175 H.P. Dick & Church.
One 250 H.P. Lake Erie Engineering Co.
One 300 H.P. Dick & Church.

500-VOLT GENERATORS AND MOTORS.

Two 100 K.W. Edison bi-polar.
One 150 K.W. Walker.
One 250 K.W. Walker.
One 500 K.W. G. E., direct connected.
One 45 K.W. Ft. Wayne, Wood.
One 30 K.W., H.I., T.-H.
One 50 K.W. Western Electric.
Two 75 K.W., M.P. T.-H.
Two D-62 T.-H.
Two M.P., 90, T.-H.
One D-40 T.-H.

Correspond with us to buy or sell anything in the Electrical Line; write for full information on anything wanted for use in Electric Railways, Electric Light and Power Stations.

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GOOD QUALITY AT REASONABLE PRICES

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1-120 K.W. West'ghouse.
1-120 " Gen. Elec.
1-100 " Ft. Wayne.
1- 70 " T.-H.
1- 60 " Stanley.
1- 60 " Gen. Elec.
1- 60 " West'ghouse.
1- 50 " Ft. Wayne.
1- 50 " West'ghouse.
1- 45 " West'ghouse.
2- 37 " West'ghouse.
1- 35 " T.-H.
3- 30 " Gen. Elec.
1- 30 " West'ghouse.

GENERATORS.

200 K.W. Siemens & Halske, 500-volt, direct-connected to Columbus engine.
100 " Siemens & Halske, 500-volt, direct-connected to Columbus engine.
100 " Thompson-Ryan, 250-volt, 600 r. p. m.
50 " Wood, 110-volt, direct-connected to Ball & Wood engine.
40 " Eddy, 110-volt, direct-connected to Payne engine.
27½ " G. E., 110-volt, direct-connected to Ball & Wood engine.
7½ " Eddy, 110-volt, direct-connected to Westinghouse engine.

Write us about Alternators, Generators, Motors, Engines, etc., to buy or sell.

MAYO & ROHRER CO.

220 Broadway New York

BARGAINS IN MOTORS.

GEORGE BENDER, . . 153 Centre Street, New York.

60 CYCLES, A. C. MOTORS.

30 H.P. 110-volt 3-phase, G. E.
10 " 200-volt, 2-phase, Westinghouse.
10 " 110-volt, 3-phase, G. E.
5 " 200-volt, 2-phase, Westinghouse.
5 " 110-volt, 1-phase, Wagner.
5 " 200-volt, 2-phase, West.
3 " 2-phase, Westinghouse.
2 " 200-volt, 2-phase, West.
1 " 110-volt, 3-phase, G. E.

500-VOLT, D. C. MOTORS.

7½ H.P. C & C.
6 " Central Elec. Co.
2½ " Holtzer-Cabot.
1 " Perret.

220-VOLT MOTORS.

15 " Edison.

Lot of 220 and 110-volt Motors from 10 to ¼ H.P.

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FOR SALE.

LOW PRICES. QUICK DELIVERY.

MOTORS.

2 ¼ H.P. 110 v. C & C.
3 ½ " 110 v. C & C.
1 ½ " 110 v. (series) C & C.
2 ¼ " 110 v. (series) C & C.
1 1 " 220 v. Lundell.
1 1 " 220 v. (series) Lundell.
1 1 " 220 v. C & C.
2 1 " 500 v. Detroit.
1 3 " 220 v. Diehl.
2 5 " 220 v. Diehl.
1 5 " 220 v. Gen. Elec.
1 5 H.P. 220 v. C & C.
1 5 " 220 v. C. & W.
3 12 " 110 v. Elec. Dyn.
1 7 " 110 v. Elec. Dyn.
1 15 " 220 v. Com.

DYNAMOS.

1 35-light T.-H.
1 100 " U. S.
2 160 " Elec. Dyn.
1 300 " U. S.
1 500 " Excelsior.
1 8 K.W. Claus.
4 30 " Edison.
1 40 K.W. U. S.
1 35-light Arc T.-H.
1 120 K.W. G. E. alternator.
1 120 " West. alternator.
1 7½ " Eddy D. C. to West. Eng.
1 40 " Eddy D. C. to Payne Eng.
1 50 " Ft. Wayne D. C. to Ball & Wood Eng.
1 10x10x10x12 Dean pump and Wheeler condenser.
1 500 Gal. Worthington Elec. pump, 220 v.

Transformers, Arc Lamps (new), Instruments.

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REPAIR SHOPS.

70 MARKET STREET, CHICAGO. TELEPHONE, MAIN 1280.

First-Class Equipment in all Shops.

OPEN DAY AND NIGHT. PROMPT ATTENTION.

Dynamos, Armatures, Motors, Arc Lamps, Instruments, Machine Shop; Engines, Etc., Carpenter Shops; Cabinets, Etc.

Correspondence Solicited.

SCRAP COPPER WIRE WANTED.

It will pay the electric plants, electric street railways and manufacturers of electrical material throughout the United States to save the Scrap Copper Wire, Scrap Brass, Platinum, etc., and ship to us. We are established for many years in the buying of scrap material, and are facilitated for handling any quantity, for which we always pay the highest value according to the market We pay prompt cash on receipt and inspection.

We also supply the electrical trade with our high-grade Babbitt Metals, Bar and Wire Solder, Cotton and Wool Waste. When in want, correspond with us.

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ELECTRIC LIGHT PLANT—MUST BE SOLD QUICK.

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Also a large stock of Dynamos and Motors, Automatic Engines, Ball, Ames and Armington & Sims, and Corliss Engines up to 500 horse-power. Also boilers.

FRANK TOOMEY,

Local and L. D. 'Phone 261 and 262.

127-129 N. Third St., Philadelphia.

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DYNAMOS, MOTORS AND ARC LAMPS BOUGHT, SOLD AND EXCHANGED

Over 100 Dynamos in stock. Most complete repair shop in the West. Write us if you wish to buy or sell.

900 125-hour, 110-volt Siemens & Halske enclosed arc lamps, entirely new, price $8.50 each.

GUARANTEE ELECTRIC CO., 133-139 So. CLINTON ST., CHICAGO, ILL

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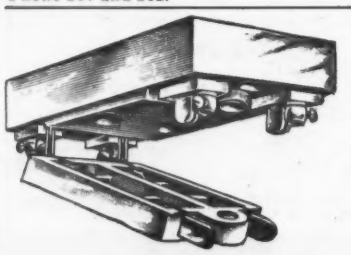

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For sale by all Supply Dealers.

Supplement to Electrical World and Engineer, November 10, 1900

THE AUTOMOBILE CLUB'S SHOW AT MADISON SQUARE GARDEN

The First Annual Exhibit of the Automobile Club of America.

FOR the first time in the United States the automobile has had an adequate representation at a popular show. It is true that there have been previous exhibits of considerable merit, as recently in Chicago, and it will not be forgotten that a very creditable display was given last year in Madison Square Garden by the National Electric Light Association at its exhibition, which was also accompanied by the first parade of electric automobiles in this country. But in many respects more important and far-reaching in its influence has been the first annual automobile show given this week under the auspices of the Automobile Club of America at Madison Square Garden. The show began on Saturday evening, Nov. 3, while the strains of the bands in the great Sound Money Parade were still echoing in the distance; but strong as was the appeal of that affair to the public, it did not in any wise diminish the attendance at the show, to which at least eight or ten thousand people flocked. The same excellent attendance has been maintained all through the present week, and "society" has also taken most kindly to the new "event" in the winter programme. In every respect the show must be declared an emphatic success, most gratifying to the members, nearly all of whom have given their time and services freely to the work of organization, judging, etc. But one shadow fell upon their pleasure, namely, the absence of Mr. A. R. Shattuck, the active and highly esteemed president of the club, who is the son-in-law of the late Mayor Strong, whose death occurred quite suddenly at the close of last week. Mr. Strong's early connection with the pioneer work of developing the Brush arc light system was freshly in the minds and remarks of many of the electrical engineers who were at the Garden during the week as the result of their personal participation in this newest evolution of electric power and the use of current from central stations or isolated plants.

THE GARDEN.

Quite a novel aspect is presented by the Garden this week. The vast roof of glass and iron is, as usual, decorated with flags, incandescent lamps, etc. As at the electrical exhibitions, there is a raised floor on the level of the boxes looking down on the arena, but this floor extends only along the north side, as the boxes and unreserved seats have all been retained on the south side to afford an opportunity

FIG. 1.—GENERAL VIEW OF AUTOMOBILE EXHIBITS AT MADISON SQUARE GARDEN.

for witnessing the official trials and contests. The general draping of the walls of the arena is in red automobile cloth, and on this rests numerous trophies showing in gilt large facsimiles of an "auto" wheel, the badge of the club. As one enters the Garden, instead of proceeding immediately to the floor of the arena, you take a steep double flight of temporary stairs to the level of the boxes. From this point of vantage a broad foot bridge takes the spectator over the track to another flight of double stairs leading down into the arena where the bulk of the exhibits are massed. Encircling the arena is a 20-foot wooden plank track, not covered with tanbark as in a horse show, but just left bare. At each end of the Garden this is properly raised on the outer edge so that vehicles can swing around nicely. At the eastern end from the entrance is a big pocket with runway in which a number of vehicles are kept for exercise on the track, but access can also be had to any part of the track from any exhibit by means of the openings of standard gauge. These are barred by stout removable beams which are replaced as soon as a vehicle has been run out of its space. All of the exhibit portion of the arena thus defined by the track is boarded off, so that the automobiles can safely carom against the smooth wooden walls without harm to themselves or the public.

The central area is given up to automobiles of all classes. Accessories are grouped on the north gallery, as described. At the main en-

FIG. 2.—THE GRADE ON THE ROOF GARDEN.

trance are placed two or three large or otherwise interesting vehicles, and the ordinary restaurant on the right of the ticket boxes has been converted into a loan collection hall, with a few overflow exhibitors. Nor is this all, for up on the roof, in the space occupied in the summer months by the roof garden, is a huge structure with stiff grade, built for the purpose of showing what hills the automobile can tackle with ease, celerity and safety. This runway is 200 feet long and at one point 53 feet above the tile floor. It is 8 feet wide, and laid on scantling. It is in four sections, running from 20 per cent grade up to 43½. At least, that is what is said; the writer has not measured the grades himself. But the spectacle of the tilted vehicle is most impressive and convincing as it negotiates these rapid declivities and stiff hills.

COMMITTEES AND EXHIBITORS.

The work of preparation for the show has been chiefly in the hands of a committee, and much credit is due its members, Messrs. A. R. Shattuck, A. C. Bostwick, C. F. Chamberlain, C. J. Field and E. S. Schwarzkopf, to whose names may be added that of the energetic new secretary, Mr. Malcolm W. Ford. The technical committee, as follows, has also had many duties to perform during the week: C. J. Field, chairman; Prof. Elihu Thomson, Dr. S. S. Wheeler, T. C. Martin, Alex. Fischer, Prof. R. H. Thurston and Carleton Macy. This committee has also enjoyed the aid of Mr. R. A. Fliess, E.E., and a great deal of excellent work has been done during the week by the new assistant secretary, Mr. F. W. Tousey. Many members of the club have also been active throughout, among whom may be named Messrs. A. L. Riker, J. Wesley Allison, W. H. Johnson, E. T. Birdsall, John Jacob Astor, A. E. Chandler, J. M. Hill, W. E. Buzby, H. M. Byllesley, E. W. Curtis, Jr., C. R. Flint, S. D. Ripley, Whitney Lyon, G. W. Day, H. W. Hedge, S. T. Davis, Jr., A. L. Barber, A. H. Whiting, J. B. Walker, E. H. Willard, Dave H. Morris, E. L. Powers, E. W. Little, F. A. La Roche, C. E. Corrigan, Col. A. A. Pope and Dr. Louis Duncan.

The following are the exhibitors, and elsewhere in these columns will be found notes of the leading exhibits: Main floor—American Bicycle Company, Autocar Company, Automobile Company of America, Baker Motor Vehicle Company, Buffalo Electric Carriage Company, Canda Manufacturing Company, Daimler Manufacturing Company, De Dion-Bouton Motorette Company, Electric Vehicle Company, Foster Automobile Manufacturing Company, Locomobile Company of America, National Automobile & Electric Company, Riker Motor Vehicle Company, Stanley Manufacturing Company, Strong & Rogers, Waltham Manufacturing Company, Woods Motor Vehicle Company.

Restaurant—Automobile Club of America, Duryea Motor Company, Edmond Motor Cycle Company, Haynes-Apperson Company, Holyoke Automobile Company, International Motor Carriage Company, Knox Automobile Company, Mobile Company of America, Munger Vehicle Tire Company, New York Motor Vehicle Company, Overman Automobile Company, Peerless Manufacturing Company, John T. Robinson & Co., Springfield Cornice Works, St. Louis Motor Carriage Company, Steam Vehicle Company, Trinity Cycle Company, Upton Machine Company. The Mobile Company of America also operate the roof garden exhibit.

Balcony—Badger Manufacturing Company, Bevin Brothers Manufacturing Company, E. A. Brecher & Co., Consolidated Rubber Tire Company, Crest Manufacturing Company, Diamond Rubber Company, Joseph Dixon Crucible Company, C. J. Downing & Co., Dow Portable Electric Company, Gleason-Peters Air Pump Company, B. F. Goodrich & Co., Goodyear Tire & Rubber Company, Gray & Davis, Hartford Rubber Works, Janney, Steinmetz & Co,. Metallic Rubber Tire Company, Chas. E. Miller, New Process Raw Hide Company, New York Belting & Packing Company, Pennsylvania Automobile & Gear Company, Rose Manufacturing Company, C. F. Splitdorf Veeder Manufacturing Company.

SPECIAL EXHIBITS.

Among the loan exhibits may be mentioned Mr. Albert C. Bostwick's 24-hp French racing machine, of Panhard-Levassor make, which won the road race from Marseilles to Nice and the Tour de France before being brought to America. Among the other famous racing machines loaned for the exhibition are a Clement voiturette, owned by Mr. Bostwick; a French voiturette, loaned by Albert R. Shattuck, A. L. Riker's road carriage, winner of the Blanchet Cup, and a De Dion racing tricycle that recently won the road race from Paris to Toulouse. A huge, cumbersome steam carriage, built in 1860 by Richard Dudgeon, is an exact duplicate of a machine which he built five years earlier and lost in the Crystal Palace fire. It consists of an iron locomotive with solid wooden wheels and flanked on either side by long cushioned seats, and is loaned by F. P. Dudgeon, of Locust Valley, L. I. Other exhibits of this character include a 90-pound steam bicycle with wooden wheels, built by W. W. Austin, and the walking automaton man, who pushes an invalid chair before him. This was built by George R. Moore, at Westford, Mass., nine years ago. On the main floor is also what must be regarded as a special exhibit in the vehicle with which a new automobile record from Cleveland to New York was made last week by Alexander Winton, of Cleveland, who started from there in this gasolene racing machine on Thursday morning, Nov. 1, and arrived here at 9:45 p. m. on Nov. 4. The distance was a little more than 800 miles, and the actual time on the road was 38 hours and 30 minutes, deducting the stops for eating and sleeping. The carriage, which weighs 1650 pounds, came through in good condition and without any breakdown until Fifth Avenue in this city was reached, when a leaf in a spring was broken. T. C. Collins accompanied Mr. Winton. This trip beats the record made by Mr. Winton a year ago last May, when he came from Cleveland here, covering 707 miles in the net running time of 47 hours and 34 minutes. The vehicle is still adorned with the mud of two or three States and several score of counties.

THE TRACK.

One great feature has been the availability and general use of the track. Afternoon and evening it has been full of vehicles moving along usually at the regulation rate of eight miles an hour, but at a

suspiciously higher speed whenever the course was a bit clear. When it is stated that some 200 different kinds of vehicles are on hand, and that pretty nearly all of them have been out on the track, some idea of the variety and animation of the spectacle may be formed—here a stately electric victoria, next a saucy little De Dion voiturette, next an electric phaeton, then a steam carriage, an electric truck, a big electric drag tooled by Mr. Barwise and loaded with passengers, Mrs. Allison in her victoria, Mr. and Mrs. Riker in their Stanhope, Mr. Rogers with his handsome Stanhope, Columbias by the half-dozen driven by Messrs. Johnson, Hill, Gotshall and others; Mr. Dow with his National "New York trap," Mr. Curtis with a Woods turnout, and so on—a scene full of endless animation and amusement.

TRIALS AND CONTESTS.

This part of the programme has been varied throughout the week by brake and obstacle contests on the track between the various vehicles in their own classes and then all types together. The series is not concluded as we go to press, but will be reported next week. Along about 400 feet of the south side of the track in the Garden

FIG. 3.—THE LANE OF BARRELS IN OBSTACLE TESTS.

these tests have been in progress all the week. The braking contests have been determined on speed and distance within which the vehicle can be halted. The interest in that is, of course, chiefly technical, but important to everybody. In the obstacle tests, there is some little fun. The obstacles have not been made heavy, so that there is a minimum of risk in colliding with them. Rows of barrels are zigzagged across the track, and the vehicle, having been started by pistol shot, is timed. After negotiating the sharp angles compelled by the first set of barrels, the driven finds himself in a short, narrow lane formed by the wall of the track on one side and a light rail fence on the other. He steers through this into a "pen" or *cul de sac,* which he can only leave by neatly reversing unless he wants to knock down one of the three sides. Having backed safely into a clear space to the right he comes ahead again only to encounter a curving alley of barrels at the end of which stands the timeeeper. It is evident that here is a chance for some pretty work, as well as an opportunity for impressing the public with the great ease with which automobiles can be handled in a crowded street. The scale of the judges is 20 for time, 20 for the barrels, 20 for into the "pen" and 40 for reversing out of it. The vehicle itself has, of course, something to do with success in such a contest, but evidently the best combination is a clever "mobler" with a light machine. It is noticeable that some of those who were clean in their record as to hitting the obstacles, sacrificed their chances of the diploma by taking the route very cautiously and slowly.

Some Technical Notes on the Show.

BY R. A. FLIESS, E. E.

TO those who have the welfare of the electric automobile industry at heart, the brave showing that is made by this type of horseless vehicle at the Automobile Show now in progress at the Madison Square Garden cannot help but be most gratifying. The eight exhibitors in this class, aggregating all told some 70 vehicles of many different styles. Of these over 45 are stationary exhibits on the main floor of the Garden, and they illustrate very forcibly to those who remember the automobile and cycle show held under the same roof less than ten months ago the great expansion that has taken place in this new field of industry in that short time.

To be sure, no very radical improvements can be noticed in running gears, motors or other mechanical features, nor could any such improvement have been seriously expected, for the reason that the purely mechanical features had already been so far perfected at the time of the last show that only minor improvements in them were necessary. There is, however, a marked improvement noticeable in the general design and finish of the vehicles, taken as a whole. The lines of the carriage and wagon bodies in the newer designs are much more graceful and are more satisfying to the eye, while the chopped-off—or where is the horse?—appearance closely associated with some of the earlier styles is in many cases no longer present. The manufacturers, it would seem, are at last beginning to take advantage of the esthetic possibilities of the horseless vehicle with good results, and a number of refinements have been incorporated in the latest productions which should add materially to the comfort and luxury of electric automobile locomotion.

A number of new styles have been added to the already long list

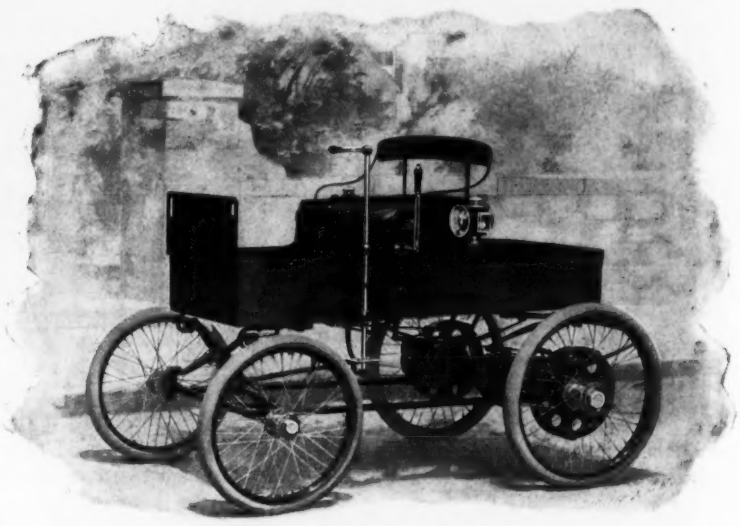


FIG. 4.—RIKER PIANO-BOX RUNABOUT.

that has been on the market for the past year. Chief among these is the "piano-box" runabout which has been put on the market by several manufacturers to supply an increasing demand for a light, graceful and neat electric vehicle, capable of accommodating two persons, and which can be purchased at a moderate and reasonable cost. Many advantages are claimed for the vehicles of this style. Among the more important ones, that of decreased weight for the same passenger carrying capacity would seem to possess the most virtue. The decreased weight, reducing the wear on the tires, thus lowers appreciably the total charge to the vehicle for an item of expense which in the heavier styles of electric vehicle is at the moment very considerable. Decreased weight also makes it possible to use a lighter weight storage battery for practically the same mileage capacity on one charge. This reduces the depreciation and repair charges on the battery, as well as the first cost and renewal charges, each of which is a large item in the heavy styles of electric vehicles. The ability in this style of vehicle to fill the cells of the battery with acid without the necessity of removing them from the vehicle is another advantage claimed, as well as the accessibility of the batteries in case repairs are necessary. It is a style of vehicle that should meet with popular favor at once.

It is quite noticeable that the tendency seems to be more and more toward the use of solid wood wheels and solid rubber tires, especially for all electric vehicles designed for commercial purposes. A

very few of the vehicles exhibited are equipped with wire wheels and pneumatic tires. These pneumatic tires are, however, used on the lighter pleasure carriages; but when the weight of these becomes great, solid tires seem to be in order. The one exception noticed to this general tendency is in the heavy hansom cabs and broughams with which New Yorkers are now very familiar. These are fitted out with 4-in. pneumatics.

It is to be regretted that a practice which can not be too strongly condemned is still in evidence at this show—though, to be sure, to a much less marked degree than formerly. The practice referred to is the very short-sighted one indulged in by some manufacturers of claiming a much greater mileage capacity on one charge of battery for their vehicles than they can accomplish under ordinary circumstances with any reasonable length of battery life. In this way the prospective purchaser is misled and—provided he becomes an owner—is in time disappointed. The dissatisfaction felt by him with his vehicle will soon make itself felt in his neighborhood and must in time react on the electric vehicle industry as a whole. On the other hand, if the manufacturer would give figures which are within the average mileage radius of action of his vehicle under ordinary circumstances, the purchaser would undoubtedly be much pleased to find some day that he could actually get more distance out of his

FIG. 5.—NATIONAL ELECTRIC "NEW YORK TRAP."

vehicle in case of necessity than he had supposed possible, and his pleasure at the discovery would certainly be of benefit to the industry. This tendency, which was at one time very bad, is now much improved, especially among the larger and older firms. The worst transgressors at present are the newer and smaller concerns.

The practice of using an underslung battery in connection with commercial vehicles, such as public cabs, delivery wagons, stages, etc., is gaining ground and would seem to be a step in the right direction.

The question of the advantage or disadvantage in suppressing the reach in electric vehicles is still, it appears, an open one. Of the newest vehicles exhibited, several of one style have no reach. It is claimed that the resulting construction adds to the easy riding qualities of the vehicle. In the heavier vehicles, however, the reach is quite generally retained.

In the spider stanhope exhibited by Strong & Rogers, of Cleveland, Ohio, an interesting arrangement of the odometer used on the vehicle is shown. The odometer is made to operate electrically by means of an electromagnet and the mechanism is placed in a neat morocco covered case, which also holds the voltmeter and ammeter and a small carriage clock. The dials of the several instruments are illuminated by means of a miniature incandescent lamp, and the whole arrangement is in plain sight of the operator. The odometer is actuated at each revolution of the wheel by means of the electromagnet, which is energized by a current which passes through two brushes resting upon the surface of a fibre ring attached to the hub of one of the front wheels. A small part of the fibre surface of the ring is replaced with a conducting surface which serves to close the circuit for an instant on each revolution of the wheel.

The same vehicle has its single motor placed close to the right hand rear wheel—not in the centre of the carriage as in most other makes employing a single motor. The object is to eliminate the weakening effect of the divided shaft which is necessary when using one motor, which drives through a single gear wheel fastened to the rear axle. A system of beveled gears are fastened to the right hand rear hub, which revolves concentrically with, but independent of, the rear axle. This system of bevel gears meshes with a second system connected to the main driving gear, which is keyed to the rear axle, as is the left hand rear wheel. By this means the solidity of an unbroken rear axle is obtained while driving through the rear axle with a single motor equipment. Several other manufacturers obtain the same end in a slightly different way. The Kensington automobile, to be seen in the annex, also has its single motor fastened close to the right hand side of the rear axle. The object sought is the same as with the Strong & Rogers carriage mentioned above. In the Kensington automobile a double reduction gear is used between the motor and the shaft, which, it is claimed, permits of a more economical motor construction due to its higher speed.

THE GENERAL ELECTRIC COMPANY exhibits, in the space of the Electric Vehicle Company, an electric hydrant which is designed to be used by electric vehicles that are in need of replenishing their batteries. The hydrants are to be placed at convenient points. They operate on the "penny-in-the-slot" machine principle. When a vehicle needs a charge, all the operator has to do is to run up to the hydrant, put a suitable charging plug in one of the four receptacles designed to receive it, and then drop a 25-cent piece in the slot and wait. There are four receptacles, each of which is numbered. No. 1 represents a charging current of 20 amperes, No. 2 a charging current of 30 amperes, No. 3 a charging current of 40 amperes, and No. 4 a charging current of 50 amperes. Provision is made by means of a push button by which the charging plug can be taken out of any one receptacle and placed in any other without cutting off the current supply paid for. The supply is about 2.5 kilowatt-hours, and when this has been furnished the current is automatically cut off, and no more can be obtained until another 25-cent piece has been put in the slot.

In connection with this charging hydrant, or "Electrant," as it is called, an interesting point is brought out forcibly. That is that of the eight makes of electric vehicles exhibited, but three use charging plugs and receptacles that are similar. The other five use specially constructed plugs, each of a different design, and none of which could be used in the receptacles provided in the hydrant. It would seem as though all electric vehicles should have a standard charging plug receptacle fastened somewhere in circuit. This would eliminate the necessity of providing several different styles of charging plugs at the different charging stations as they spring up. To most persons uniformity would seem to be desirable. It is to be hoped that the manufacturers will get together and decide upon one standard form.

RIKER.—Of the eight exhibitors of electric vehicles, the Riker Motor Vehicle Company, of Elizabethport, N. J., had the largest number of vehicles on exhibition on the opening night. This company occupies two spaces in different parts of the Garden on the main floor, and shows one vehicle in the loan collection of the Automobile Club of America in the annex. It also has several vehicles in the space which is provided as a repository for vehicles that are to be used on the track which encircles the main exhibition floor. In all the company exhibits some 18 to 20 vehicles. This exhibit includes a light runabout and two victorias of a style already familiar. There is a station cab for public service, which has an underslung battery equipment, and a square-front brougham for private use. An ambulance is also shown. Also an emergency wagon, which is provided with a sand box and conducting tubes arranged to guide the sand from the box to and under the back wheels. In this vehicle, which weighs some 6400 lbs., and has a speed of 12 miles an hour, the sand box arrangement will probably be found a very serviceable adjunct. Close to the emergency wagon is a 20-passenger omnibus of very handsome design, and near by a 4-ton truck. A 2-ton truck and a piano box runabout are stored in the space at the back of the Garden for use on the track. The Riker racing machine which won the Blanchet Cup in the 50-mile all America race last spring, is shown in the annex. The company also exhibits a break with seating capacity for 12 people beside the operator, which, it is claimed, has a speed of 12 to 14 miles per hour. One of the newest and by far the most elegant electric vehicles shown at the show is the "Victoria de Luxe" of this company. It is a beautiful example of the carriage builders' art

FIG. 6.—EXHIBIT OF THE WOODS MOTOR VEHICLE COMPANY.

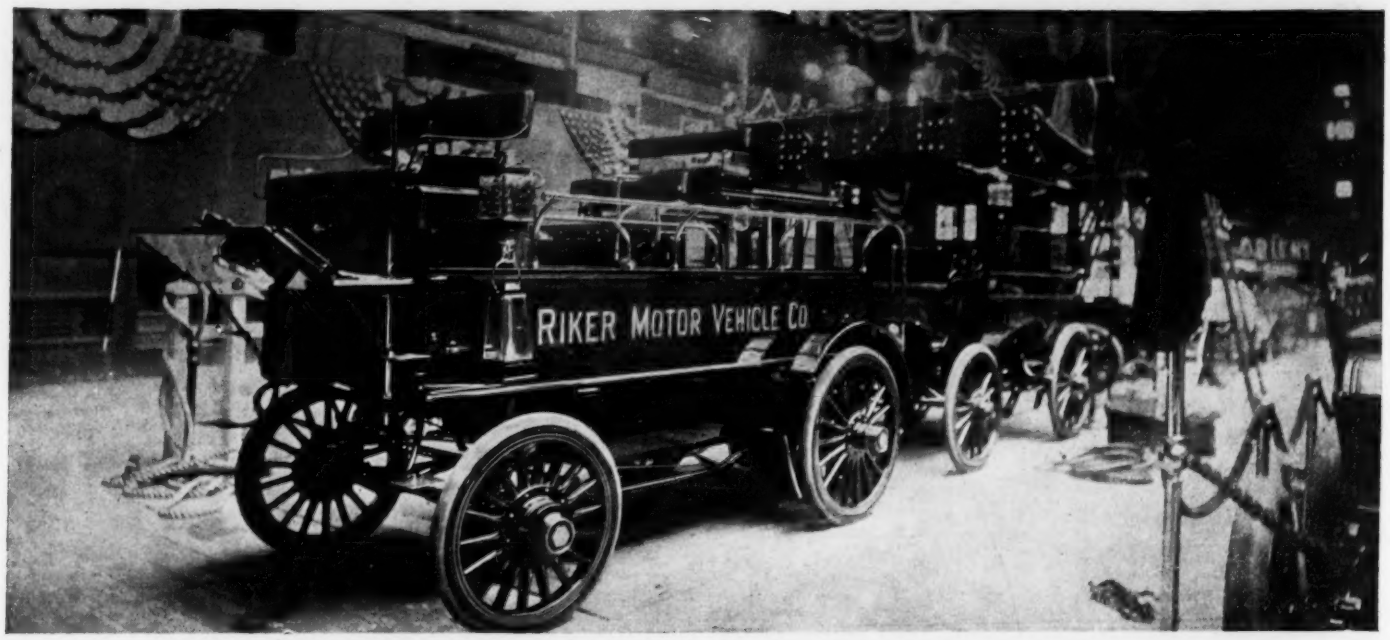


FIG. 7.—ONE PORTION OF THE RIKER EXHIBIT, SHOWING STREET RAILWAY EMERGENCY WAGON.

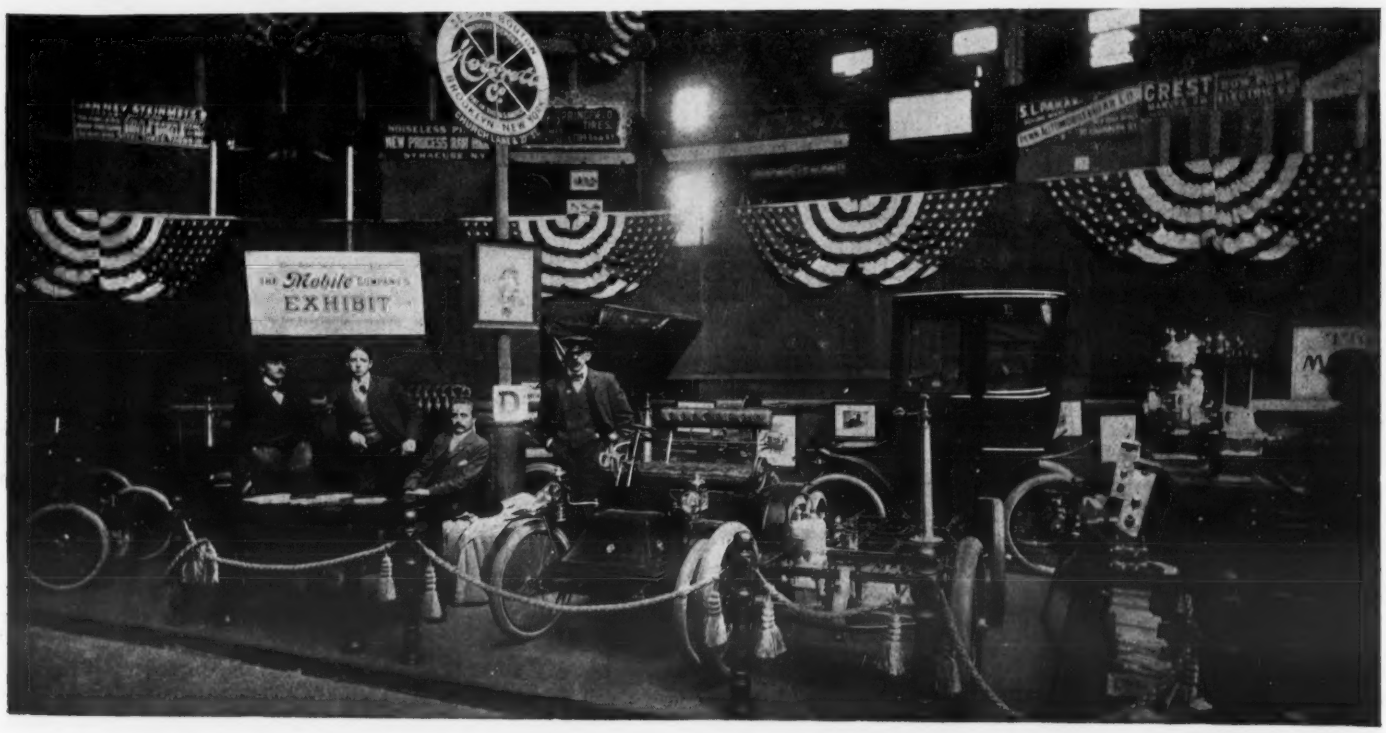


FIG. 8.—DE DION-BOUTON MOTORETTE EXHIBIT.

and its lines are the most esthetic that the writer has yet seen embodied in a horseless vehicle. The body is supported on its own separate springs and it is suspended from these springs by straps, as in the familiar horse-drawn Victoria of the same style. The battery, which is divided into two sections, is carried on springs which rest on the running gear. Thus the body of the vehicle is entirely separate from the running gear, battery or driver's seat. This gives it all the lightness and ease which would be possible in a horse-drawn body, and at the same time the luxuriously steady motion not possible of attainment with a horse-drawn vehicle. The Riker Company has made no perceptible change in its well-known mechanical features.

Electric Vehicle Company.—The next largest exhibit of electric vehicles is made by the Electric Vehicle Company, of New York. This company exhibits some fifteen vehicles in one space, including two delivery wagons with underslung batteries, a straight-front brougham, an extension-front brougham, a cabriolet and a rear-foot victoria. This latter is one of the newer creations of this company and is a very pleasing looking vehicle. Besides the above, the company also shows a hansom such as New Yorkers are familiar with, a theatre bus, a phæton, a four-passenger surrey, a small victoria, a runabout, a wagonette and a touring car. The latter, it is claimed, has a possible mileage quite beyond any which it is possible to obtain tected from dirt and moisture by the same case as is used to protect the motor. A rocker-plate is used in connection with the rear X-spring support, which gives flexibility to the system. A novel way of lubricating the motor bearings is employed. A chain is used instead of the usual metal ring so much employed in stationary motors. The advantages claimed are those of less space occupied and more positive action. The back axle is solid and the gear cases are made of heavy sheet metal, so arranged as to be easily removed for inspection. They are made adjustable, to allow the substitution of different sized pinions. This company also provides an electric brake of a very ingenious construction. In fact, it is an emergency switch, locking device and electrical brake, all in one. The handle which operates it is conveniently placed within a few inches of the controller handle, and things are so arranged that the handle works up and down in a perpendicular plane. To operate the brake the handle is pushed down past one, two, three or four notches, as circumstances demand. When the handle is pushed down to the first position the current is cut off from the motor, no matter in what position the controller handle is. Hence, the first position serves as an emergency switch. There is a lock provided in the top of the handle which, if turned with the handle in this position, will effectually prevent the vehicle from being stolen when left in the street unattended. Pushed down past

Fig. 9.—Exhibit of the Electric Vehicle Company.

with the standard designs. It has a very long battery box and seating capacity for but two people. This company also has several vehicles in the back of the Garden for use on the track.

The National Automobile & Electric Company, of Indianapolis, has the third largest exhibit of electric vehicles on the main floor. It shows, in all, seven different different styles in its stationary exhibit and keeps several other vehicles in the back of the Garden for use on the track. This company, which is one of the latest to enter the commercial field, makes a strong showing for such a young aspirant for automobile honors. It exhibits three runabouts, a stanhope, a park trap, combination delivery, and a four-passenger break. All its vehicles are equipped with but one motor, whose curves indicate very high efficiency. Its light road wagon, equipped with a ½-hp motor, for which 88 per cent efficiency at normal load is claimed, shows, perhaps, the greatest variation in design. Its weight is approximately 1000 lbs., and it has no reach. The body is carried on a system of X and elliptical springs. The driving is accomplished through the front and rear elliptical springs, it is claimed. The result is a very easy carriage, especially on rough ground. The construction is very light and simple. The front axle is hollow and the motor is spring suspended and drives from both ends of its shaft. The differential and band brake are both on the armature shaft and are pro- the first notch to the second position, the switch throws the armature of the motor in series with a resistance. The motor then acts as a dynamo and tends to retard the vehicle. Before the electric brake handle can be pushed past the first to the second position, however, the controller handle must be brought back to its zero position. If the hill is so steep that the vehicle reaches too high a speed with the electric brake handle in the second position, it can be pushed down to the third position. With the arrangement of the resistances in this position, more work is done by the dynamo, and consequently the speed of the vehicle is retarded. If the third position of the handle does not cut the speed down to that desired, the fourth one is available. With the electric brake handle in the fourth position, it is claimed any hill may be descended in perfect safety, and, of course, without wear on the brake shoe or brake band operated by the foot, one of which kind is always provided.

The American Bicycle Company, manufacturer of Waverley electric vehicles, exhibits five electric vehicles on the main floor and has several vehicles in the back of the Garden for use on the track. It shows a four-passenger break, four-passenger surrey, road wagon, combination delivery wagon and a six-passenger break. The new style piano box road wagon, just turned out by this company, is a very neat little vehicle. It is said to weigh less than 1000 pounds, and

is equipped with a 2-hp six-pole motor. Its battery equipment is 40 cells of 30 amp.-hour capacity, the total weight of which is said to be 360 lbs. The cost of such a vehicle is but $750, which is a great point in its favor. This vehicle is built without a reach, and the back axle is of a somewhat new design in electric vehicles, though in a general way similar construction may be noticed in several of the light ve-

FIG. 10.—THE STRONG & ROGERS STANHOPE.

hicles exhibited that use steam as a motive power. A good point which is incorporated in this vehicle is the use of a brake rod to connect the foot brake attachment with the band. This seems better practice than to employ a light wire rope, as is done by several firms with their lighter vehicles. An interesting little point which shows the refinement of detail that is beginning to be introduced into the horseless

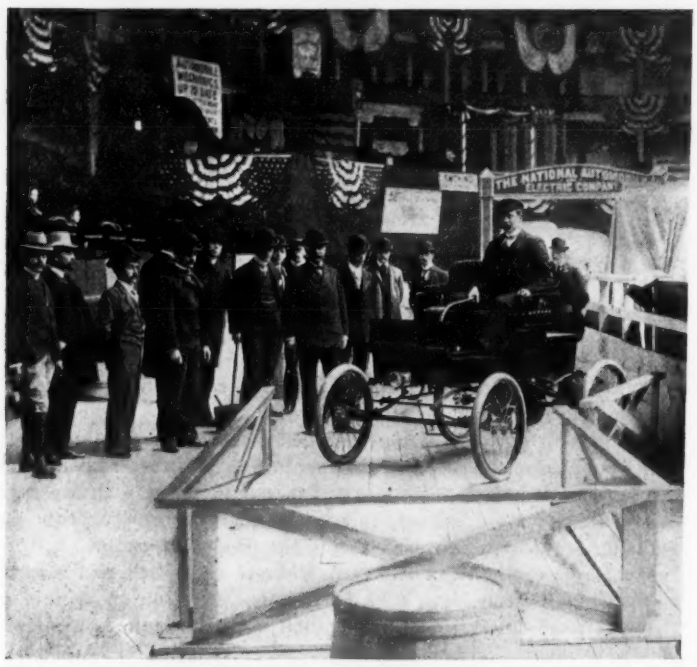


FIG. 11.—OBSTACLE TESTS: GOING INTO THE PEN.

vehicle industry is the arrangement of the little incandescent light which is used to light up the dial of the volt and ammeter used on this vehicle. The switch is so arranged that a slight pressure of the left foot of the operator on it closes the circuit and lights the lamp. When the pressure is removed the circuit is opened automatically by means of a spiral spring suitably placed with respect to the plunger of the switch. This little road wagon is one of the style noted above that is making its appearance for the first time on a large scale at the show, and it is to be hoped that this style will be exploited extensively, as it makes a very neat and desirable little trap.

THE WOODS MOTOR VEHICLE COMPANY, of Chicago and New York, exhibits five vehicles on the main floor. It has, however, a large number of vehicles of various makes in the back of the Garden for use on the track. It shows a stanhope, station wagon, runabout, brougham and victoria. Its victoria is a very fine specimen of the carriage builders' art, the iron work on the reach being an especially

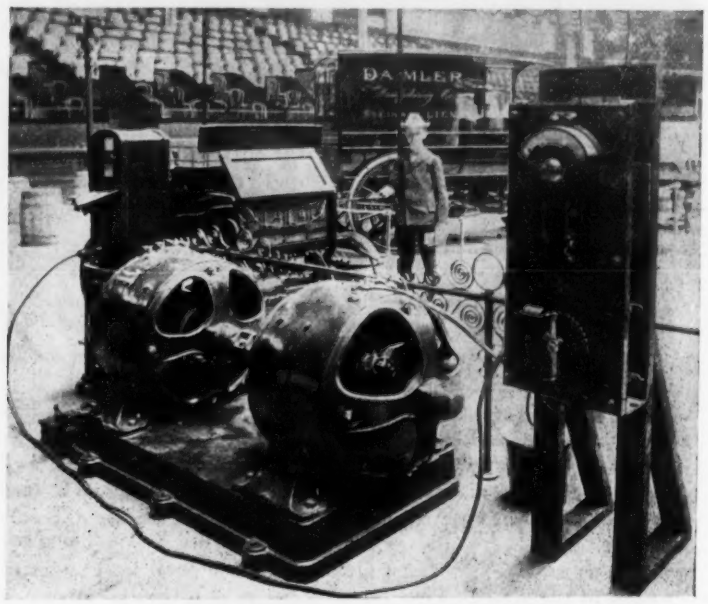


FIG. 12.—"ELECTRANT" AND CHARGING OUTFIT.

good piece of work. This company shows no new designs. Those exhibited are already familiar.

BAKER.—One of the smallest and lightest but by no means the least interesting of the electric vehicles exhibited is the little piano box road wagon made by the Baker Motor Vehicle Company, of Cleveland. This little vehicle has a carrying capacity of two persons and weighs complete but 550 pounds, it is said. The battery equipment is ten Willard cells, which are placed out of sight under the seat. The battery is divided into two trays of five cells each, and the vehicle has two speeds of six and twelve miles an hour. A ½-hp motor is used of

FIG. 13.—EXHIBIT OF AMERICAN BICYCLE COMPANY.

high speed, and the power is transmitted to the rear axle by means of a chain and sprocket. The arrangement of the frame is very closely approximate to that used, and now so familiar in the light steam runabouts seen so often on our streets.

THE BUFFALO ELECTRIC CARRIAGE COMPANY, of Buffalo, N. Y., exhibits three of its Buffalo stanhopes on the main floor, and has

one in the back of the Garden for use on the track. The particular features of interest in this carriage are two. The first is the use of

FIG. 14.—EXHIBIT OF BUFFALO ELECTRIC CARRIAGE COMPANY.

wood reaches, which it is claimed add elasticity to the movement of the carriage. The reach is made of hickory and it is claimed as an advantage of this construction that it can, if necessary, be repaired by any country blacksmith. The second feature in this vehicle is the use of a construction which uses no tubing. The motor is hung as in two of the other makes already noted, close to the right-hand wheel, the object being the same as before, namely, the use of a solid rear axle.

Taken as a whole, the first annual automobile show held under the auspices of the Automobile Club of America is a very great success. It has shown that an art, which but a few years ago was practically unknown, has sprung up and that it has been developed into a strong and rapidly expanding department of industry which in a few years bids fair to rival some of those many years older.

Against Automobile Shows.

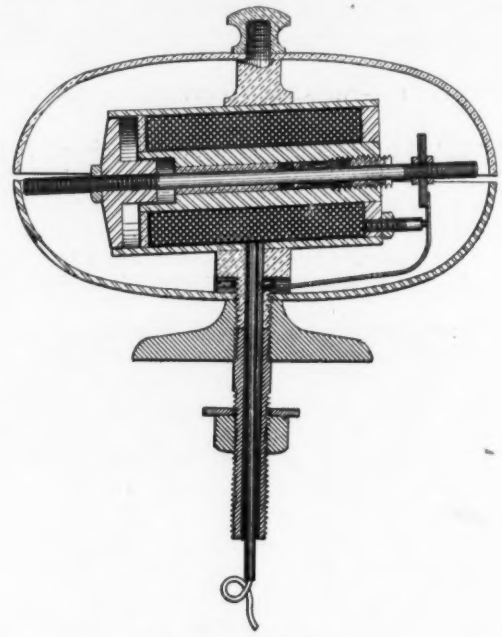
It is noted by the New York *Sun* that even while the Automobile Show is in progress a movement is on foot among the manufacturers to do away with such affairs in the future. Attempt will be made to form a federation among the makers, possibly an organization similar to a board of trade, with an agreement not to patronize shows after a given date. The reason for this step is to be found in the experience of bicycle manufacturers, who for years were heavily mulcted by show promotors in various cities. So long as a few of the leading makers engage spaces at a show all the others feel obliged to be represented. In consequence of this, shows have been a heavy drain on cycle makers. It is expensive to hire space in a hall for a week, pay for decorating and lighting the booth, for transporting the exhibits to and fro, and, more than all, to distract the attention of principals and employees from their regular duties for ten days. The plan formulated by a few and in which an effort to get all others to join will be made, is to start a big train of automobiles around the country next March. The train will visit all cities of consequence and remain from one to three or four days in each, in order that the natives may inspect the automobiles and have them explained to them. It will be a peripatetic show that will cover the whole country and it is thought will accomplish more with no greater expense than going into one show after another.

The "Wake 'Em Up" Automobile Bell.

This bell, invented by Harry E. Dey, is a novelty in the electric line, being based on entirely new principles and design. The magnet is of the ironclad type entirely enclosing the coil, making the latter absolutely waterproof. The hammer is a steel rod which has a reciprocating motion through the axis of the magnet. The latter being inclined at a slight angle causes one end of the rod to strike one bell, the other end on its return striking the opposite bell, and being differently, but harmoniously, toned produces a very pleasing vibrating chime.

The design is such that it is an ornament to any part of the vehicle. The whole mechanism is placed inside the bells, doing away with the unsightly box. The method of attaching to the vehicle will be readily understood from the cut. On electric or gasolene vehicles no extra battery will be required. On steam vehicles a dry battery can be used for the purpose.

Mr. Dey, from practical experience with any different kinds of mechanical and electric bells and the French horn, has found that there is nothing to compare with the electric bell for clearing a way, reliability and convenience, and the last item is of considerable more importance than might at first appear. The majority of vehicles have at least three levers, steering, speed control and foot brake. It is easy to take care of the speed and steering levers, one in each hand, but with those requiring the use of the foot it is more difficult. It is very uncomfortable to keep the feet in one position for any length of time, consequently they are seldom on the brake or bell. In an emergency, a person has to work the controlling lever with one hand, the steering with the other, feel around for the brake with one foot, and, he has a mechanical bell, dance on that with the other. At the same time it is very important that he should keep his eye on the danger ahead. With the electric bell, a simple pressure of the thumb on the end of either lever disposes of the foot tattoo which is the most awkward movement of the lot; there is no stepping on it in entering or leaving the carriage, and the small boy does not "get on to" the point of application, and then proceed to awaken the neighborhood when the vehicle is left standing in the street. The sound is easier to locate and does not have the paralyzing effect of a single stroke or toot, and has a more soothing effect on horses. The writer has frequently seen horses keep perfectly quite at the approach of an automobile until the gong clanged, and then they would prick up their ears and become



NEW ELECTRIC BELL.

restive. A bell that rings continuously when desired permits of a notable gain in speed.

The present standard size of this bell is five inches, but other sizes will be manufactured. It is also applicable to street railway work, can be operated from a storage cell that is in series with the lamps. When the lamps are lighted the cell will charge more than enough to make up for the amount used during the day.

Mr. Dey is the inventor and manufacturer of the bell, and is located at 711 136th Street, New York City. The bell is on exhibition with the DeDion-Bouton motorette exhibit at the automobile show in Madison Square Garden this week.

NOTES.

SEVERAL ITEMS and descriptions of interest will appear in our pages next week, collected too late for this issue and Automobile Supplement.

A SUPPER will be given to the exhibitors by the club at the Garden on Friday night, after closing. A great attendance is expected Saturday night.